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Including the Proceedings of the
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XIV SEPTEMBER 21, 1925 NUMBER 16

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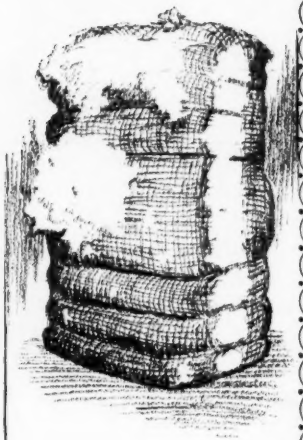

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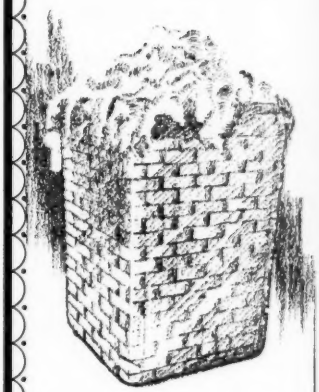

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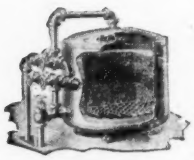

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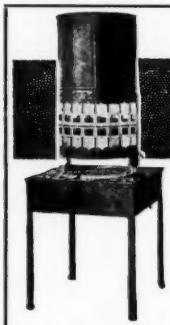

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VOLUME XIV NEW YORK, SEPTEMBER 21, 1925 NUMBER 16

The Fading of Colored Materials by Daylight and Artificial Light*

Materials and Test Methods—Methods of Determining Degree of Fading—Rate of Fading—Intensity-Time Relations in Fading—Effect of Spectral Character of Incident Radiation—Effect of Temperature—Effect of Moisture—Fading Under Daylight and Artificial Light—Discussion and Conclusion

By M. LUCKIESH† and A. H. TAYLOR‡

SYNOPSIS.—An investigation has been made to determine the relative rates of fading of colored materials by daylight and artificial light. The effects of various factors, such as illumination intensity, spectral character of the radiation, temperature, humidity, etc., have been studied. Colored silk ribbons were used for the tests. The average results of tests on twenty-three ribbons show that exposure to sunlight and skylight at 3,900 foot-candles for eleven hours, or to skylight alone at 450 foot-candles for forty hours, will cause as much fading as exposure to 500 foot-candles from tungsten lamps for one hundred hours. Also, that approximately equal degrees of fading will result from exposures to tungsten filament radiation for 100 foot-candle-hours, skylight for 34 foot-candle-hours, or to sunlight and skylight combined for 77 foot-candle-hours.

THE fading of colored materials exposed to daylight and various kinds of artificial light has been studied by a number of investigators.[1] Their studies have covered many of the factors involved, but the complexity of the subject leaves room for further investigation. Since daylight is variable in intensity and spectral character, the primary object of many investigations has been the standardization of test procedure with various artificial sources of radiation. Such sources are usually fairly constant in intensity and spectral character, and may be selected to give reproducible results in less time than with daylight.

The present tendency in the use of high intensities of illumination in show-windows has raised the question as to whether or not the high illumination and greater amount of heat will seriously increase the fading of colored materials displayed in the windows. In show-windows receiving a large amount of daylight a very careful analysis may be necessary in order to determine relative damage by natural and artificial radiation.

Many factors are involved in fading, and any study of the subject is made more complex by the difficulty of controlling them. Some of the factors which may be important are: character, color and concentration of dye, material dyed and method of application of dye; intensity of illumination; spectral character of radiation; temperature, humidity and purity of atmosphere, etc. Fading proceeds slowly with many materials, and during the time of exposure to daylight there will be great changes in atmospheric humidity, as well as in the spectral character of the radiation. More rapid fading by daylight is to be expected in summer than in winter because of longer days and more intense visible and ultraviolet radiation.

In order to obtain data regarding the relative rates of fading of representative colored materials by daylight and artificial light, an extensive investigation has recently been completed by this laboratory. Because of the time and labor involved it has been necessary to limit the number of colored materials tested. However, we believe that it has been sufficient to indicate the character of the results which would be obtained with a much larger number. It is hoped that the data obtained will be of interest and value to illuminating engineers and others interested in high-intensity illumination.

Materials and Test Methods

The materials selected were colored silk ribbons one-half an inch wide, purchased in a Cleveland department store. Forty-three different specimens ranging in shade from very light tints to saturated colors were used. The

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*A paper presented before the annual convention of the Illuminating Engineering Society, Detroit, Mich., September 15-18, 1925

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[1] For bibliographies see Mott, Trans. Am. Electro-Chemical Soc., 28, p. 388, 1915, and Cunliffe, Am. Dyestuff Reporter, 1924, pp. 428, 466, 489

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most of these cost 8 cents per yard, although a few cost 17 or 25 cents. It was felt that such ribbons would give results fairly representative of colored dress goods usually displayed, although the ribbons might be somewhat more easily faded. For some of the tests short strips of the ribbons were wrapped around strips of glass about 5/8-inch wide and amounted in glass tubes, each strip

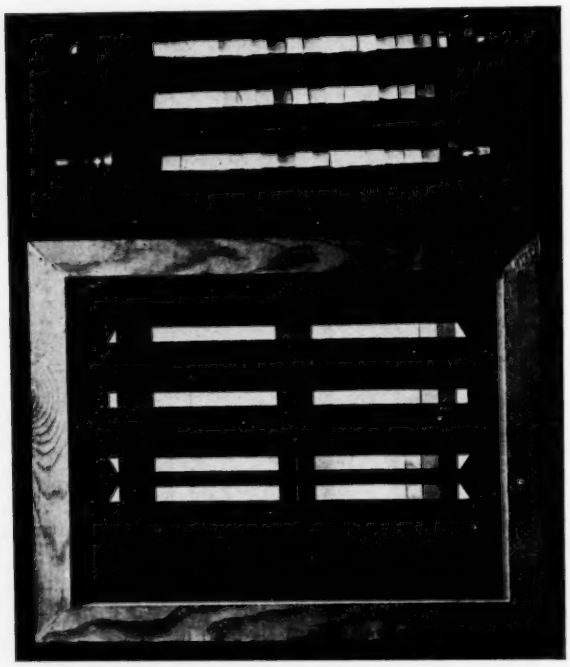

FIG. 1.—*Photograph of One of the Ribbon Exposure Frames and Three Ribbon Tubes.*

having about eighteen different ribbons on it. Some of the tubes were left open at both ends; some were sealed with air; some were evacuated; and some were tabulated to provide for attachment of rubber hose and circulation of dry or humid air. In some of the later tests long strips of the ribbons were stretched across a sheet of stiff cardboard. They were covered with a black cardboard mask, having removable narrow strips cut away to allow exposure of a narrow band across all the ribbons, and the whole was placed under glass in a frame This permitted exposure of juxtaposed strips to different illuminants, and facilitated comparisons to determine relative exposures for equal fading. One of the frames and some of the tubes are shown in Fig. 1.

For the exposures to radiation from tungsten lamps, two sets of three booths were made up. One set of booths was constructed of wood, forming a cabinet 74 inches by 22 inches by 38 inches. This was divided into three equal compartments, two with black walls and one with white walls. Gas-filled tungsten lamps of different sizes were used to obtain intensities of 5, 50 and 500 foot-candles. A heating coil in each compartment was adjusted so as to maintain a temperature of approximately 120 deg. Fahr. The second set of booths consisted of a skeleton framework covered with black cloth. The 500 foot-candle booth was lined with white cloth. A fan was used to circulate the air so that the temperature in the high intensity booth did not exceed the room temperature by more than 10 to 15 degrees. The other two booths were maintained at 50 and 5 foot-candles at approximately room temperature.

Some exposures were made in a 15-inch sphere painted white inside and containing a 100-watt lamp. The intensity of illumination was approximately 2,700 foot-candles, and the temperature 140 to 150 deg. Fahrenheit. Exposures to a white-flame arc-lamp were made at an average of approximately 650 foot-candles. The glass tubes were arranged as follows: open at both ends; sealed with air; evacuated; with circulating air from the room; with circulating air from a drying chamber; with air circulated through water to saturate it.

The illumination in the various booths was adjusted to the desired intensity in each case and checked several times during the tests. Daylight illumination in the exposure plane was measured frequently. Of course, it is not to be expected that fading would proceed at an equal rate when the material is exposed to daylight and artificial light of equal luminous intensity, since the spectral character of the radiation is not the same. However, in store and window lighting we are primarily interested in illumination as evaluated by the eye; hence, illumination measurements were made instead of measurements of total energy.

METHODS OF DETERMINING DEGREE OF FADING

In the first part of the work, when only the ribbons in glass tubes were exposed, the degree of fading was determined by direct comparison with unexposed ribbons, using an accurate artificial daylight unit for the illumination. Fading was arbitrarily divided into five grades as follows:

Grade 0—Not faded.
Grade 1—Just perceptibly faded.
Grade 2—Appreciably faded.
Grade 3—Very badly faded.
Grade 4—Practically bleached or colorless.

Two observers agreed fairly well in their estimation of fading by this method, especially in the first three grades, but it was decided that actual standards were necessary if consistent results were to be obtained. Such standards were prepared by exposures to very high-intensity radiation from tungsten lamps for various lengths of time. There was an appreciable difference in amount of fading between successive grades established, but this difference was of the same general order as that between grades in the previous system. Ribbons exposed under the various conditions were compared with these standards under a color-matching unit. In order to make this comparison more accurate, a white-lined box was made up and a polarization photometer inserted through one side. Illumination was furnished by two "daylight"

lamps. The ribbon tubes were placed adjacent to each other so that the two ribbons to be compared were seen in the two semi-circular fields of the photometer respectively. When two ribbons have faded approximately the same amount it is difficult to determine when they are exactly alike even by these methods, and, consequently, in an extreme case a particular ribbon which fades very slowly may be evaluated as equal to a certain grade at all inspections over a period of several hundred hours. When an intermediate standard is used to compare ribbons exposed under different conditions, this grading must be made at least twice for each pair of ribbons compared, hence there is the possibility of doubling the experimental errors. Finally, a great many direct comparisons were made between ribbons exposed under various conditions to different illuminants, in order to determine relative exposures to cause equal fading. Data obtained from all three methods of grading have been used in drawing the conclusions presented in this paper. A further complication in obtaining reproducible results is the possibility that fading may continue after the exposure is completed. There is no easy way to avoid or to allow for any such effect.

Rate of Fading

It was found in most cases that fading was perceptible earliest with the light tints of blue and red, and last with the yellows. One ribbon of blue tint and one of an orchid color showed fading after 100 hours' exposure to 50 foot-candles from tungsten lamps and duplicates showed fading after 6 hours in sunlight. This is not necessarily a characteristic of these colors, but is possibly an indication of lack of fastness of these particular dyes. Since it is of importance to know how soon fading becomes apparent with the different illuminants, Tables I and II have been prepared to show the degree of fading at various times during the period of exposure.

Intensity-Time Relations in Fading

In order to determine whether equal fading would be produced by exposure to tungsten radiation equal in the product of illumination and time, but differing in the magnitude of each of these two factors, certain comparisons have been made. Ribbons exposed to tungsten light at an intensity of 2,700 foot-candles at approximately 140 to 150 deg. Fahr. were directly compared with others which had been exposed to intensities of 50 and 500 foot-candles at 120 degrees for various lengths of time. From these comparisons the relative exposures, evaluated in foot-candle hours for equal degrees of fading, were determined. Two sets of ribbons which had been exposed to 50 foot-candles for 810 and 1,514 hours, respectively, and two others which had been exposed to 500 foot-candles for 760 and 1,787 hours, respectively, were used for these comparisons. The temperature differences between the exposures at different intensities might possibly have made some small differences in the results, but these differences were not easily avoidable.

The *average* results of these comparisons indicate that equal fading will result when the total exposures in foot-candles hours are in the following proportions at the three intensities; 100 at 2,700 foot-candles; 120 at 500 foot-candles; 105 at 50 foot-candles. Apparently, a greater exposure would be required at 500 foot-candles than at 50 or 2,700. This does not appear to be reasonable, since the exposures must again approach equality as the illumination approaches 2,700 foot-candles. In fact, the differences observed are not very large compared with the uncertainties of measurement and the unavoidable fluctuations of intensity of radiation; therefore, for all practical purposes we may assume that within the ranges of illumination encountered in practice the fading of colored materials is directly proportional to the exposure in foot-candle hours for lights of equal distribution.

Effect of Spectral Character of Incident Radiation

It has been well established that the ultraviolet or short-wave component in sunlight is very effective in promoting many chemical reactions and that any light-source rich in ultraviolet or short-wave visible radiations will fade colored materials faster than one which is deficient in this part of the spectrum. The short-wave limit of the solar radiation is practically at 290 *mu*. In order to determine the long-wave extent of the solar spectrum which is effective in causing fading, fifteen colored ribbons were stretched over cardboard and enclosed in two frames with cardboard masks. Transverse slits in the masks, covered with various glasses, permitted exposures to the portions of the solar spectrum transmitted by them. Glasses were selected which gave fairly sharp cut-offs

Table I.—*Degree of Fading of Test Ribbons After Exposure Under Glass to Radiation from Gas-Filled Tungsten Lamps for Various Lengths of Time at Temperatures from 80 to 90 deg. Fahr.*

Grade 0, no fading detectable; Grade 1, just perceptibly faded; Grade 2, appreciably faded; Grade 3, very badly faded; Grade 4, practically bleached or colorless.

Ribbon No.	Color*		Grades reached after various exposures—50 foot-candles: 120 hrs.	190 hrs.	265 hrs.	340 hrs.	500 foot-candles: 120 hrs.	190 hrs.	265 hrs.	340 hrs.
1	Chestnut	S-3925	0	0	0	0	0	0	1	1
3	Ecru	S-3183	0	0	0	0	0	0	0	0
4	Delft	S-6185	0	0	0	1	2	2	3	3
5	Lt. Blue No. 4	S-6109	0	0	0	0	1	1	1	2
6	Turquoise	S-6153	1	1	2	2	3	3	4	4
7	Mignonette	S-5183	0	0	0	0	0	0	0	0
8	Light Blue-gray		0	0	0	0	0	0	0	0
9	Maize	S-3115	0	0	0	0	0	0	0	0
10	Gold	S-4815	0	0	0	1	0	1	1	1
11	Orchid	S-7183	0	0	1	1	2	2	3	3
12	Apricot	S-4123	0	0	0	0	1	1	1	2
13	Pink No. 3	S-2107	0	0	1	1	1	1	1	2
14	Salmon Pink	S-2145	0	0	0	0	1	1	1	2
15	Lt. Laurel Pink	S-2135	0	0	0	0	1	1	1	2
16	Strawberry	S-2185	0	0	0	0	0	0	0	1
17	Geranium	S-2035	0	0	0	0	0	0	1	1
18	Ruby	S-2065	0	0	0	0	0	0	1	1
Number perceptibly faded			1	1	3	5	8	9	12	13

*Color names and numbers refer to "Standard Color Card of America" issued by the Textile Color Card Association of the U. S.

at the short-wave end and were highly transparent and practically uniform in their absorption for the remainder of the spectrum. All excepting the fused quartz were obtained from the Corning Glass Works. The glasses used and the radiation of shortest wave-length transmitted are shown in Table III. Spectrograms of the glasses and the tubing in which other ribbons were exposed are shown in Fig. 2. The glasses were arranged in the order shown in Table III. Exposures to direct sunlight were made for a sufficient length of time to cause appreciable fading of all the ribbons.

TABLE II.—*Degree of Fading of Test Ribbons After Exposure Under Glass to Radiation from Sun and Sky, and from Sky Without Sun, at Average Illumination and for Hours Indicated.*

Grades reached after exposures indicated.

Ribbon No.	Exposed to sun and sky — Average 3,800 ft. c.				Exposed to sky — Average 550 ft.-c.			
	6 hrs.	18 hrs.	30 hrs.	52 hrs.	20 hrs.	31 hrs.	40 hrs.	56 hrs.
1	0	0	1	2	0	0	0	0
3	0	0	1	1	0	0	0	0
4	0	1	2	3	1	1	1	2
5	0	0	1	2	0	1	1	1
6	1	1	2	3	1	1	2	2
7	0	0	0	1	0	0	0	0
8	0	0	0	1	0	0	0	0
9	0	0	0	1	0	0	0	0
10	0	0	0	1	0	0	1	1
11	1	1	2	3	0	1	2	2
12	0	0	1	2	0	0	0	1
13	1	1	2	3	1	1	2	2
14	0	1	1	2	0	0	1	1
15	0	1	1	2	0	1	1	1
16	0	0	1	1	0	0	0	0
17	0	0	1	1	0	0	0	1
18	0	0	0	0	0	0	0	0
Number perceptibly faded	3	6	12	16	3	6	8	10

The most of the ribbons showed progressively less fading from quartz to the G-34-R glass, but all showed some fading in every exposure strip. For the majority of the ribbons the reduction of fading between steps was hardly more than might be expected on account of the reduction in total radiant energy transmitted by successive glasses, although no means were available for evaluating the difference in fading or amount of energy received. However, seven of the ribbons showed a very marked difference in the amount of fading produced by light transmitted by glasses G-34-T and G-34-O, which cut off, respectively, at 557 and 577 *mu;* and three of the seven showed very little fading with the latter glass. This would apparently indicate that energy of wave-lengths between 557 and 577 *mu*, from yellow-green to yellow, is much more effective in causing fading with some dyes than all energy of the solar spectrum of wave-lengths longer than 577 *mu*. In general, the results indicate little difference in the "fading power" of radiations of various wave-lengths from 290 *mu* to about the middle of the visible spectrum.

It has long been recognized that energy must be absorbed in order to be effective in fading colored materials; therefore, we might expect a red ribbon to fade faster under solar radiation than under radiation from tungsten lamps, since the former contains a relatively larger proportion of short-wave radiation (absorbed by the red ribbon) than the latter. However, the absorption of energy of a particular wave-length does not necessarily result in fading, and, hence, the color of the material may not give any indication of the color of the light or wave-length of radiation which will cause the greatest amount of fading. In fact, the results of these tests do not exhibit any conspicuous relationship between the wave-length of the energy absorbed (in the visible spectrum) and the amount of fading produced. Hence, we may conclude that the absorption spectrum of a colored material cannot do more than indicate a group or groups of radiations among which those responsible for fading are to be found.

EFFECT OF TEMPERATURE

As stated above, exposures to tungsten light were made at 5, 50 and 500 foot-candles, at temperatures of approximately 85 and 120 deg. Fahr. Ribbons which had been exposed at 85 degrees for 800 and 1,500 hours were directly compared with others which had been exposed for the same length of time at the same illumination intensities but at a temperature of 120 deg. Fahr. Only ten out of one hundred forty ribbons showed any difference in amount of fading which could be detected without very close examination. Such differences as were observed were very small, but with the exception of one ribbon they showed a slightly greater fading at the higher temperature. These results are in general agreement with those obtained by other investigators, since they have found the temperature effect to be very small. Ribbons kept in the dark at 120 degrees for 1,500 hours showed no fading whatever in comparison with others kept in the dark at ordinary room temperatures. A very appreciable increase in fading was obtained at 150 degrees over that at 90 degrees. Quantitative results of this part of the tests were not available at the time this paper was prepared.

TABLE III—*Designation of Glasses Used in Study of Effect of Wave-Length of Radiation on Fading, and Shortest Wave-Lengths Transmitted by Them.*

Glass	Shortest wave-length transmitted
Quartz*	about 180 *mu*
Thin pyrex	313
Special plate	313
G-385	365
G-38-A	435
G-38-H	480
G-34-T	557
G-34-O	577
G-34-R	577

*Quartz is transparent far beyond the short-wave limit of solar radiation reaching the earth's surface.

TABLE IV.—*Relative Exposures in Hours for Equal Fading of Various Ribbons Exposed Under Glass to Radiation from Various Illuminants*

Ribbon No.	*Color		Relative hours' exposure—Tungsten lamp 500 ft.-c.	White flame arc **650 ft.-c.	Sunlight and skylight **3000 ft.-c.	Skylight **450 ft.-c.
			%	%	%	%
1	Chestnut	S-3925	100	50	20	50
3	Ecru	S-3183	100	—	10.5	—
4	Delft	S-6185	100	—	8.5	74
5	Lt. blue	S-6109	100	70	9	21
6	Turquoise	S-6153	100	—	8.5	57
7	Mignonette	S-5183	100	46	10.5	14
8	Lt. blue-gray		100	—	—	31
9	Maize	S-3115	100	28	9	16
11	Orchid	S-7183	100	116	13	94
12	Apricot	S-4123	100	61	11	58
13	Pink No. 3	S-2107	100	48	8	27
14	Salmon pink	S-2145	100	50	11	44
15	Lt. laurel pink	S-2135	100	67	12	50
16	Strawberry	S-2185	100	79	22	89
17	Geranium	S-2035	100	—	12	38
18	Ruby	S-2065	100	28	14	36
19	Blossom	S-1283	100	46	7	34
20	Copenhagen	S-6183	100	74	11	40
21	Tobacco	S-3945	100	12	6	13
22	Ecru	S-3183	100	108	15	—
23	Nile green	S-5143	100	45	9	21
24	Goldenrod	S-4025	100	—	10.5	13
25	Lt. blue	S-6109	100	58	9.5	15
Average			100	58	11	40

*Color names and numbers refer to "Standard Color Card of America," issued by the Textile Color Card Association of the U. S.

**Approximate average illumination during tests.

EFFECT OF MOISTURE

In order to determine the effect of moisture upon the rate of fading two ribbon tubes were arranged for continuous circulation of moisture-saturated air and completely dried air, respectively. The illuminant was the white-flame arc. The ribbons were compared with the standard faded ribbons at various stages of the exposures and were compared with each other after 340 hours. There did not appear to be any appreciable difference in the degree of fading of ribbons exposed in moist and dry air, but in a few cases the final colors were slightly different in tint under the two conditions. The texture of the ribbons in moist air was very appreciably changed.

EFFECT OF VACUUM

A number of ribbon tubes were evacuated and exposed under the various conditions. One set of ribbons was exposed to 500 foot-candles from tungsten lamps at approximately 85 deg. Fahr. for 1,500 hours. After this exposure it was found that about one-half of them showed no perceptible fading and that only one-fourth of the total number were badly faded. Even these were faded much less than ribbons exposed in the open air for the same length of time.

FADING UNDER DAYLIGHT AND ARTIFICIAL LIGHT

Exposures of ribbons in glass tubes and also under glass in frames were made to direct sunlight between the hours of 8.30 a. m. and 5 p. m. They received both sunlight and skylight, and when there was snow on the ground a considerable amount of light was received from it as they were placed in a vertical plane. Other tubes were exposed to skylight without sunlight at the same time. The exposures were begun the last of December, but the major portion of the exposure was during March, April and May. Illumination measurements were made at frequent intervals and exposures in foot-candle hours were computed. In the direct sunlight the average total illumination for the whole test period was 3,900 foot-candles. In April the average was 5,000 foot-candles. The average illumination of the ribbons exposed to skylight without sunlight was 450 foot-candles.

Ribbons exposed in the glass tubes in this manner were graded by use of standard faded ribbons. Also, a great many direct comparisons were made with ribbons exposed to radiation from tungsten lamps, in order to determine relative exposures for equal fading. The results are shown in Tables IV and V. Table IV shows the relative time of exposure under glass for equal fading for 500 foot-candles from tungsten lamps, for approximately 650 foot-candles from the white-flame arc, for sunlight plus skylight and for skylight without sunlight. The exposures to 50 and 500 foot-candles from tungsten lamps are used as the bases of comparison. Data for various exposures from 100 to 1,600 hours of tungsten light have been combined on the assumption that time ratios for equal fading with two different illuminants are constant, regardless of the actual length of exposure, over the time range used in these tests. Many of the values are averages of several fading equality determinations, although some represent only one determination. The daylight and tungsten radiation data are plotted in Fig. 3 (page 636).

In Table V and Fig. 3 are presented the relative amounts of exposure (foot-candle hours) required for equal fading of the various ribbons under daylight and radiation from gas-filled tungsten filament lamps.

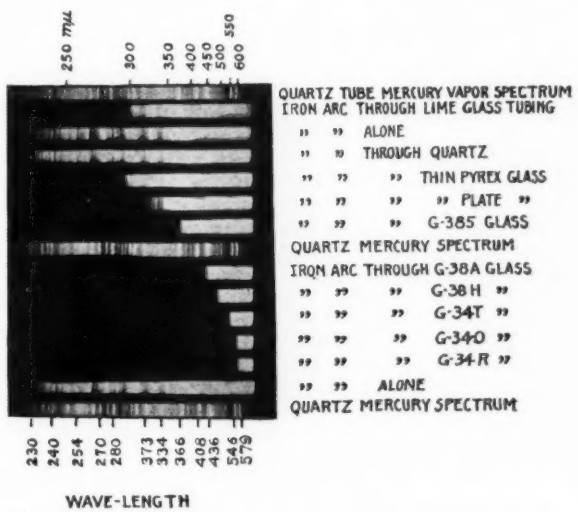

FIG. 2.—*Spectrograms of Iron Arc Through the Various Glasses Used in Studying the Effect of Spectral Character of the Radiation Upon Fading of Colored Materials.*

Table VI summarizes the data presented in Tables IV and V and shows the ranges of exposure which result in equal fading of various percentages of the ribbons under different exposure conditions. For example, 50 per cent of the ribbons required three to eight times the hours exposure to 500 foot-candles of tungsten lamp radiation that they required under skylight at approximately 450 foot-candles.

Some inconsistencies will be noted between the second and third columns of Table V. They are aprtly due to the great difficulty in measuring the degree of fading. Other work described earlier in this paper as well as other data in hand, would lead to the conclusion that exposures to the same illuminant at 50 and 500 foot-candles should require very nearly the same total foot-candle hours for equal fading. However, it is important to note that in only one case was it found that the skylight exposure exceeded the tungsten light exposure.

Other comparisons of the relative exposure time for equal fading in daylight and in radiation from tungsten lamps were made by the use of the frame shown in Fig. 1. One strip of cardboard was removed from the mask, allowing exposure of a transverse strip across all the ribbons. Exposure was made to 500 foot-candles from tungsten lamps at room temperature for 200 hours. This strip was then covered and another strip immediately adjacent was exposed to sunlight and skylight in a southwest window. The ribbons received only skylight until noon, then sunlight also for the remainder of the day. Exposures were for 24-hour periods. After three days' exposure nearly all ribbons had faded as much as, or more than, those exposed to 500 foot-candles from tungsten lamps for 200 hours. After exposure for a few hours longer only one ribbon was less faded than the 500 foot-candle exposure strip.

Similar exposures of another strip were made to skylight alone, the frame being placed in a northwest window. After being exposed for thirteen days, practically all ribbons had faded as much as those exposed to 500 foot-candles of tungsten light for 200 hours.

TABLE V.—*Ratio of Exposures (Foot-Candle Hours) of Daylight to Light from Gas-Filled Tungsten Lamps for Equal Fading of Different Ribbons Exposed Under Glass.*

Ribbon No.*	Relative footcandle-hours for equal fading: Skylight to 50 ft.-c. tungsten	Skylight to 500 ft.-c. tungsten	Sunlight and skylight to 500 ft.-c. tungsten
1	0.46	0.22	0.86
3	—	—	.84
4	—	.67	.66
5	.42	.14	.60
6	.58	.52	.66
7	—	.14	.77
8	—	.27	—
9	.22	.16	.66
11	1.02	.69	.63
12	0.77	.55	.79
13	.57	.23	.57
14	.80	.50	.80
15	.59	.46	.82
16	—	.80	.51
17	—	.34	1.02
18	—	.35	1.05
19	.36	.19	—
20	—	.40	.95
21	—	.12	.97
22	.22	.11	.88
23	.30	.15	.48
24	.22	.11	.84
25	—	.16	.72
Average	0.50	0.34	0.77

*See Table IV for color.

TABLE VI.—*Relative Exposures of Various Colored Ribbons to Daylight and Tungsten Filament Light Necessary for Equal Fading of Duplicate Ribbons*

Skylight vs. Tungsten Filament Light.

Relative exposures in hours: Skylight approx. 450 ft.-c.	Relative exposures in hours: Tungsten lamps 500 ft.-c.	Ribbons equally faded; % of total exposed	Relative exposures in footcandle-hours: Skylight approx. 450 ft.-c.	Relative exposures in footcandle-hours: Tungsten lamps 500 ft.-c.	Ribbons equally faded; % of total exposed
100	100 to 175	25	100	125 to 200	24
100	200 to 300	25	100	200 to 500	33
100	300 to 800	50	100	500 to 1000	43

Sunlight and Skylight vs. Tungsten Filament Light.

Relative exposures in hours: Sunlight and skylight approx. 3900 ft.-c.	Relative exposures in hours: Tungsten lamps 500 ft.-c.	Ribbons equally faded; % of total exposed	Relative exposures in footcandles hours: Sunlight and skylight approx. 3900 ft.-c.	Relative exposures in footcandles hours: Tungsten lamps 500 ft.-c.	Ribbons equally faded; % of total exposed
100	500 to 800	23	100	95 to 125	43
100	800 to 1000	36	100	125 to 150	19
100	1000 to 1700	41	100	150 to 200	38

Discussion and Conclusions

There are only twenty-three ribbons represented in Tables IV, V and VI, but they were quite varied in hue and shade; therefore, the average result will probably be approximately representative of colored goods in general, at least in respect to the relative rate of fading by different illuminants. The rate of fading of cotton and silk dyed with the same dye might be appreciably different, but the ratio of exposure to two different illuminants for equal fading would probably not vary a great deal for the two materials. Assuming this reasoning to be correct, it follows that approximately equal fading will be caused by exposures as follows:

(a) 500 foot-candles from tungsten lamps for 100 hours.

(b) 3,900 foot-candles of sunlight plus skylight for 11 hours.

(c) 450 foot-candles of skylight for 40 hours.

In other words, for these intensities, skylight is approximately two to three times, and sunlight plus skylight approximately nine times, as effective in fading as 500 foot-candles from tungsten lamps. Furthermore, the intensity of sunlight in summer is often considerably higher than 3,900 foot-candles, and it contains a greater amount of short-wave radiation, hence it would probably be considerably more effective in fading than during the time of these tests.

The actual daylight illumination in show-windows depends on many factors, and no average value can be assumed as representative. Harrison and Sturrock[2] in a

[2]Trans., I. E. S., 20, No. 2, 125, Feb., 1925.

(Concluded on page 637)

The Classification of Raw Silk by Means of Mechanical Tests

PART III—Methods of Measuring the Properties of Raw Silk

Amount of Silk Used in Testing—Preliminary Winding Test—Tenacity of Strength Test—Method of Testing Cohesion—Measuring Cleanliness and Evenness

By KARL R. MOORE

IN selecting silk for testing, the first consideration is the amount of silk to be taken in order that the test will accurately represent the lot. Silk is sold to large consumers in five, ten and twenty bale lots and, generally speaking, a five or ten bale lot may represent the product of as many different filatures as there are bales. In almost every case, however, the single bale is the product of one filature, and the five and ten bale lots will come from filatures in the same district. It has been found by making a large number of check tests that by taking two bales out of each five-bale lot or three bales from each ten and withdrawing twenty skeins from each of twenty books in each bale selected for testing, and then measuring the cleanness and evenness defects in 1,000 yards from each skein, 500 from the inside of the skein and 500 from the outside, the number of defects and the values found from this yardage will remain constant for the lot.

Preliminary Winding Test

In order to gain an idea of the throwing qualities of the silk and the number of split ends, twenty selected skeins are soaked in the usual fashion and wound onto bobbins, and the results of this winding are tabulated by an experienced winder. The results do not go on the finished quality report, except that the number of split ends found is recorded there. This preliminary winding test is made under humidity conditions of 65 to 70 per cent relative humidity and at a temperature of 70 to 75 deg. Fahr. The thread is wound off at a speed of 180 yards per minute and the amount of silk wound is 300,000 yards, so that the time consumed will be about one hour and a half. The results are noted on the Winding Test Sheet Form No. 1.

Tenacity of Strength Test

This test is performed upon the serimeter in a room of relative humidity 65 to 70 per cent and at a temperature of 70 to 75 deg. Fahr. From the bobbins wound from the twenty selected skeins from each bale 22½ meters are wound from each bobbin, tying on to make a continuous skein. This skein is cut in two and thirty unknotted threads are drawn out and tested for strength on the serimeter. The average break of the thirty skeins is noted. To obtain the percentage figure for the Quality Report Form A-406 from the average breaking strength, which is in grams, take the compound size found by weighing the first 10,000 yards reeled upon the gauge reel. Silk breaking at four times this reeled size is rated upon the quality sheet as having 100 per cent tenacity. Silk breaking at three and three-quarter times this size is rated at 93 per cent tenacity; at three and one-half times, at 86 per cent tenacity; at 3.16 times the rating is 80 per cent, and at three times, 73 per cent. By interpolation multiples falling between the above figures may be given their corresponding percentages.

406 **WINDING TEST SHEET FORM NO. 1**

Tag 37227 Date ..... Name 4

Stock & Grade Best #1 to Extra

No. Ends Tested 20 Thread Speed 180

Starting Run Started 9 Stopped 9-15 Time 15

Time: Winding Test Started 9-15 Stopped 10-40 Time 85

Remarks .....

BREAKS; Starting Run Don't Count These Breaks.	BREAKS; Winding Test. Count These Breaks.	Summary
Fine ✓	IIII IIII IIII IIII	
	IIII IIII IIII II	37
Loose III		
Other Defects Bad reel		
	First End	8
	Double Skein	
	Count Total	45

FORM A 406

RAW SILK CLASSIFICATION

Form A-406

BROOKLYN LABORATORY October 6 192

LOT NO. _____ MARK _____ SELLER M.A. & Co BALE NOS. 30654/63

STOCK Japan Filature CHOP Round Stork GRADE GIVEN B#1 to Ex

SIZE " 13/15

APPEARANCE

COLOR		LUSTRE	HAND OR TOUCH	HAIRYNESS PENALTY	SKEIN	GUMS
WHITE X IVORY CREAM	VERY EVEN EVEN X FAIRLY EVEN UNEVEN VERY UNEVEN	VERY GOOD X GOOD FAIRLY GOOD FAIR POOR VERY POOR	VERY SILKY SILKY NERVY X FIRM STRAWY SPONGY	VERY BAD 5 per cent. BAD 3 per cent GOOD 0	ST. AMERICAN X IMITATION STRAIGHT CROSS OTHERS	SOFT X HARD NARROW BROAD

MEASURABLE QUALITIES ARE BASED ON 300,000 YDS. MADE ON 80,000 YDS.

	40M	40M BALES TESTED			AVERAGE	EVENNESS	CLEANNESS
Bales No.	30660	30656			300,000	Yards	
Winding Count							
Raw Knots	10	11			78		
Very Fine	5	4			33	x 4 132	
Fine	14	20			178	x1 178	
Coarse	6	14			75	x4 2 150	
Waste	4	5			33		x1 33
Very Large Knots	3				11		x1 11
Large Knots		2			7		x½ 3
Nibs	9	10			71		x1/20 3
Very Large Slugs							x1
Slugs	18	9			101		x½ 50
Very Large Loops							x1/20
Loops	4				15		x1/20
Split Ends	3	8			41		
Bad Throws	8	6			52		x1 52
Cork Screws							x1/20
TOTAL DEFECTS						TOTAL 460 % 60	TOTAL 152 % 90
Compound Size 13.9						Average Size	13.9
Standard Size						Average Size	
Tenacity Grams 14	56					Relative Value	100 %
Cohesion Strokes 1700						Relative Value	91 %

QUALITY SCALE BASED ON RELATIVE VALUES

%	GRADE	%	GRADE
100		81	
99		80	Best
98	XXX	79	No. 1
97		78	
96		77	
95		76	
94	XX	75	
93		74	No. 1
92		73	
		72	
91		71	
90		70	
89	X	69	1 to
88		68	1½
87		67	
		66	
		65	
86		64	
85	Best No. 1	63	No. 2
84	to	62	
83	Extra	61	
82		60	

QUALITY SUMMARY RELATIVE VALUES

STRENGTH 100 %
COHESION 91 %
AVERAGE 96 %
EVENNESS 60 %
CLEANNESS 90 %
COMMON VALUE ALL QUALITIES 82 %
PENALTY 0 %
QUALITY No. 82 %

DISPOSITION OF LOT

REMARKS:

SIGNATURE

Method of Testing Cohesion

The cohesion test is made upon unsoaked silk. Twenty skeins are wound onto bobbins and five bobbins are placed in an ordinary 450-meter sizing reel having a spacing of about sixty threads to the inch. Black hard-finish cardboard is then cut in strips about 1 inch wide and 4½ inches long. From each of the bobbins placed on the spindles of the reel ten turns are reeled off successively through the same pot-eye, tying to make the strand continuous. One of the strips of cardboard is then placed under the fifty spaced threads on the reel, and the threads are pasted down at the ends of the cardboard and then cut off. The cardboard is then placed in the cohesion machine and the number of strokes noted on the counter that it takes to open up every thread under the roller. (The roller must first be checked by chalking it to make certain that it goes over every thread on the board.) On the completion of this test it is repeated with a second set of bobbins, and this is continued until the threads of all twenty bobbins have been placed in the machine and opened. The average maximum number of strokes for the four cards is then taken as the cohesion figure of the bale. This is translated into the percentage cohesion for the Quality Report Form A-406, as follows: 2,200 strokes is taken as 100 per cent cohesion, 2,100 as 99 per cent, and for each fifty strokes below 2,100 the percentage cohesion figure drops 1 per cent. For example, a silk opening up on an average of 1,500 strokes would be rated at 87 per cent for cohesion.

Measuring Cleanness and Evenness

These structural qualities are measured by running the unsoaked silk through steel gauges onto a calibrated measuring reel. Prior to each test it is necessary to check up the grooves in the gauges through which the silk runs with feeler blades, which are small thickness gauges having weights hung on them. The gauges when properly set will just suspend the feeler blade with the weight without slipping. The bobbins are then placed in the pegs on the reel and the threads passed through the gauges and tied on the reel. The operator then starts the reel, noting each defect that appears in the gauges. Defects of evenness, such as fine and coarse threads, are verified by testing the breaking strength of the single end upon a special scale made by the Toledo Scale Company. Defects of cleanness, such as waste nibs, etc., are compared with charts showing the defects slightly enlarged by the camera for identification. These defects of cleanness and evenness are enumerated upon a denominator adding machine placed conveniently at hand. When the counter on the reel shows 1,000, indicating that 10,000 yards have been reeled, the reel is stopped. The skeins are tied up and rewound into bobbins, and the results of the test as shown by the adding machine are transferred to Gauge Test Form C, shown below, and placed in the first 10,000-yard column. This test is repeated until 40,000 yards have been reeled in a similar manner.

To obtain the quality percentage for evenness as found on Form A-406, the number of fine ends found in 40,000 yards, as shown on Quality Form C, is multiplied by 7½ to obtain the number of fine ends that will appear in 300,000 yards, or 1 pound of silk. The very fine ends, those breaking on the Toledo scale below 24 grams for all sizes of silk, or 50 per cent below the average strength of the thread as shown by the tenacity test, are multiplied

GAUGE TEST FORM C

Lot 47 Date ..... Name .....

Stock and Grade ..... Bale No. 37221

Test Started ..... Stopped ..... Test Time .....

	10M	10M	10M	10M	10M	10M	Total	300,000 yds.
Winding knots	1	2	2	1			6	
Raw knots	4	8	5	6			23	
Very Fine	1	2		2			5	
Fine	2	4	3	3			12	
Coarse	2	2	2	1			7	
Waste	2		2	3			7	
Very large knots								
Large knots			1				1	
Nibs	7	5	3	3			18	
Very large slugs								
Slugs	12	10	10	9			41	
Very large loops								
Loops								
Split ends		1	1	1			3	
Bad throws	1	3	2	3			9	
Cork screws								
In doubt								
Total	32	37	31	32			132	

Remarks

by a quality penalty factor of four. The fine, or those threads breaking 30 per cent below the average for the thread, are multiplied by one. The very coarse threads, breaking 50 per cent or over above the average strength of the thread, are multiplied by a quality penalty factor of two.

The sum total of the number of very fine, fine and coarse threads found for 300,000 yards multiplied by their respective quality penalty factors is then translated into quality percentages in accordance with the following: Zero equals 100 per cent evenness; 9 equals 99 per cent evenness; and for each successive multiple of 9 the quality is lowered by 1 per cent until 72 per cent is reached. From this point the quality percentage drops 1 per cent for each 18 points of uneven silk appearing in 300,000 yards.

To find the quality percentage for cleanness, the number of defects found in the Gauge Test for C is multiplied by 7½ to give the defects for 300,000 yards, or 1 pound of silk. The different forms of defects occurring are then multiplied by their respective penalty factors as they appear on Form A-406. The sum total of these is translated into a percentage figure for the quality report, as follows: Zero equals 100 per cent cleanness; 15 equals 99 per cent cleanness; and for each successive multiple of 15 the quality is lowered 1 per cent until 72 per cent

(*Continued on page 627*)

Dyeing Acetate Silk

Part XIV

(*Continued from page 593*)

Celatene Dyes—Their Fastness on Acetate Silk—Application of Celatenes on Acetate Silk Unions—The Cellit Dyes—Dyeing Unions and Silk Effects—Suitable Union Colors

By CHARLES E. MULLIN, M.Sc., F.A.I.C.

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ONE of the recent very successful classes of direct dyes for acetate silk is the Celatene dyes* of Scottish Dyes, Ltd. Very little is known regarding their exact constitution, as they are only mentioned in the Color Index, but the manufacturers state that they are anthraquinone derivatives, and the Scottish Dyes were possibly the first to successfully use the anthraquinone derivatives for acetate silk dyeing. In the dispersal dyes we have seen many of the anthraquinone compounds applied to acetate silk with a great deal of success. However, it appears that the Celatene dyes may differ somewhat from the products we have just considered, in that the Celatene products may be sulphonated to a slight extent, whereby they are rendered considerably more soluble in water without losing their affinity for the acetate silk. The Celatenes are pastes somewhat resembling the pastes of the dispersal class, and it is possible that these dyes may be pastes composed of certain simple sulphonated anthraquinone derivatives which are slightly soluble and have an affinity for acetate silk, in a water-soluble solvent, similar to those used for the dispersal dyes just described.

It is well known that certain simple sulphonated anthraquinone derivatives have a direct affinity for acetate silk. The influence of the sulphonic group is well illustrated by a comparison of Alizarine Saphirol B, which is the sodium salt of 4, 8-diamino-1, 5-dihydroxyanthraquinone-2, 6-disulphonic acid, and Alizarine Saphirol SE, which is the sodium salt of 4, 8-diamino-1, 5-dihydroxyanthraquinone-2-sulphonic acid. As the B brand contains two sulphonic groups, it has much less affinity for acetate silk than the SE, which has only one sulphonic group. Both have considerably less affinity for this fiber than the unsulphonated diaminodihydroxyanthraquinone.

It appears probable that such sulphonated anthraquinones would be particularly suitable for application by the dispersal process. While highly sulphonated products are not usually very soluble in organic solvents and do not, as a rule, have an affinity for acetate silk, in this case the sulphonation is probably not carried to this point, and the result is a colloidal product which is slightly soluble, level dyeing and very fast. Probably British Patent No. 214,112 covers products suitable for sulphonation and application by this process.

The Celatenes will dye acetate silk under almost any condition which does not destroy the fibers. For instance, they may be applied either in a neutral, acid or alkaline (soda ash) bath, with or without Glauber salt, in long or short baths, at from room temperature up to 75 or 80 deg. Cent. (167 or 176 deg. Fahr.), with good results, only the exhaustion varying somewhat under the different conditions, as would be expected. For certain purposes, such as dyeing knit goods, a short bath in a jig is used, but for yarns longer baths are used.

While the Celatene dyes do not appear to be as yet very well known in America, it is understood that their use is rapidly increasing in England, and that they give clear, brilliant shades of excellent fastness. At present the following shades are available, and it is understood that the range is to be considerably increased: Yellow, Fast Light Yellow, Gold Orange, Orange, Light Brown 2B, Fast Light Brown, Red B, Brilliant Red, Red-Violet, Brilliant Violet B, Brilliant Violet 2R, Green, Blue and Black. It is interesting to note that these anthraquinone products are also applicable to wool, silk, straw, tagel, jute, coir, hemp, paper pulp, etc.

Method No. 94: Celatene Dyes on Acetate Silk.—These dyes are applied in a twenty or forty to one dye bath, according to the type of apparatus used, the shorter baths giving much better exhaustion. The necessary quantity of dyestuff paste is added directly to the bath without any other additions to the bath and the temperature raised to 60 deg. Cent. (140 deg. Fahr.). As in some instances all of the dye may not go into solution, the bath may not always be clear at the start, but this does not interfere with level results when properly handled.

The material should be well wet out by one of the previous methods before entering the dye bath. The acetate silk is entered at about 40 to 60 deg. Cent. (104 to 140 deg. Fahr.), raised to 70 or 85 deg. Cent. (158 to 185 deg. Fahr.) in one-half hour, and worked until the desired shade is obtained. The exhaustion is usually pretty good in one-half to three-quarters of an hour. Where very dark shades are desired, it is best to use a standing bath and dye to shade, refreshing the bath with about five-eighths of the starting weight of dyestuff. The dyed

*The author is indebted to Dr. Thomas and Dr. L. J. Hooley, of Scottish Dyes, Ltd., for much of the data given on the Celatene dyes.

TABLE NO. XI—FASTNESS OF CELATENE COLORS ON ACETATE SILK

TESTS	Light	Loss in Depth	Washing Tests: Bleeding on Viscose and Cotton	Bleeding on Wool and Silk	Bleeding on Celanese	Bleaching	Street Mud
Celatene Yellow	m/p	g	ex	ex	g	ex	ex
Celatene Red B	vg	m	vg	vg	m	ex	ex
Celatene Brilliant Violet B	ex	vg	vg	vg	g	ex	ex
Celatene Red Violet	ex	g	vg	vg	m	ex	ex
Celatene Brilliant Violet 2R	ex	vg	ex	vg	vg	vg	ex
Celatene Orange	vg/g	g	ex	g	m	ex	ex
Celatene Blue	g/m	vg	vg	vg	ex	g	vg
Celatene Fast Light Yellow	ex	..	..	..	..	..	..
Celatene Fast Light Brown	ex	..	..	..	..	..	..

TESTS	Milling: Loss in Depth	Milling: Bleeding	Cross-Dyeing: Alk. Hydros	Cross-Dyeing: Glauber Acid	Cross-Dyeing: Chrome & Acid	Rubbing: Wet	Rubbing: Dry	Perspiration: Alkaline	Perspiration: Acid
Celatene Yellow	vg	ex	p	ex	vg	ex	ex	ex	ex
Celatene Red B	vg	g	p	g	ex	ex/vg	ex/vg	vg	vg
Celatene Brilliant Violet B	ex	ex	p	vg	vg	ex	ex	vg	vg
Celatene Red Violet	ex	ex	p	vg	vg	ex	ex	vg	vg
Celatene Brilliant Violet 2R	g	ex	p	vg	p	ex	ex	ex	ex
Celatene Orange	vg	g	p	vg	vg	ex/vg	vg	ex	ex
Celatene Blue	ex	vg	g	ex	ex	vg	vg	ex	g

TESTS	Hot Pressing: Change in Shade	Hot Pressing: Staining	Acid Spotting: H_2SO_4	Acid Spotting: Acetic	Leveling
Celatene Yellow	ex	ex	ex	ex	ex
Celatene Red B	ex	vg	ex	ex	ex
Celatene Brilliant Violet B	ex	g	ex	ex	vg
Celatene Red Violet	ex	g	ex	ex	ex
Celatene Brilliant Violet 2R	ex	g	ex	ex	vg
Celatene Orange	ex	vg	ex	ex	ex
Celatene Blue	ex	ex/vg	ex	ex	ex

[Remarks: Ex, excellent fastness; vg, very good fastness; g, good fastness; m, moderate fastness; p, poor fastness.]

Celatene Fast Light Yellow, Celatene Fast Light Brown and Celatene Gold Orange redden on soaping, but this is removed by a weak sour.

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material should be rinsed well and dried; or, better yet, soaped at 60 deg. Cent. (140 deg. Fahr.) in a 1 per cent soap bath, to render the shade slightly brighter and faster to rubbing before drying. While these dyes have excellent leveling properties, in case of difficulty the temperature of the dye bath may be lowered—for instance, to 30 deg. Cent. (86 deg. Fahr.)—and a longer time given.

The application of these dyes depend upon their slight solubility in water, together with their great affinity for acetate silk. The small amount of dyestuff in solution when the goods enter the dye bath is quickly absorbed by the acetate silk, thus allowing more of the suspended dye to dissolve and be absorbed until almost complete exhaustion of the dye bath takes place. Two per cent of Red-Violet will give a medium shade, but as much as 20 per cent or even 30 per cent (black) of some of these dyes is required for the very heavy shades. Table No. XI gives some data on the fastness of a few of the Celatene dyes. It is interesting to note that Celatene Fast Light Yellow is faster to light on acetate silk than any of the vat yellows on cotton.

These fastness tests were conducted as follows: Bleaching.—The dyed yarn was bleached for one hour in a fresh cold 2-deg. Tw. bleach bath. Hot Pressing.—Dyed yarn sample was pressed between two pieces of mercerized cloth with a hot iron. The perspiration test was the same as for vat colors on cotton, using both acid and alkaline perspiration. Rubbing tests were made both wet and dry. Cross-Dyeing.—(a) Effect of alkaline hydrosulphite; (b) effect of 20 per cent sodium sulphate and 2 per cent sulphuric acid at 75 deg. Cent. (167 deg. Fahr.) for one hour; (c) effect of 1 per cent bichromate at 75 deg. Cent. for one hour. Washing Test.—(a) One per cent soap at 60 deg. Cent. (140 deg. Fahr.) in three periods of two hours each, or a total of six hours; (b) one per cent soap at 80 deg. Cent. (176 deg. Fahr.) in three periods of two hours each, or a total of six hours. Light test was to sunlight, under glass. The leveling test was made by entering a plaited hank of acetate silk into the dye bath at 75 deg. Cent. (167 deg. Fahr.) and allowing it to remain untouched for one hour.

Celatene Red-Violet is the fastest member of the series

to light, and after six months' exposure of light shades only a slight fading was noticed, while darker shades required twice this period of exposure. This is equal to that of the best vat dyes on cotton. Celatene Fast Light Yellow and Light Brown approach this fastness, and even tints of the yellow are unchanged after six months' exposure. In heavier shades ten months' exposure reddens the shade. Under the same exposure the brown shows only a slight fading, which is equal to any of the fast vat dyes giving similar shades. The light fastness ot Celatene Brilliant Violet 2R is similar to that of Caledon Brilliant Purple RR (Indanthrene Brilliant Violet RR or Ponsol Violet RR) on cotton. The shade fades slightly and is redder.

Celatene Brilliant Violet B withstands almost six months' exposure, when it becomes redder. This compares favorably with the Caledon, Algol and Indanthrene Brilliant Violet R on cotton. Celatene Orange is browner after two months' exposure, but then remains almost unchanged. Medium shades of Celatene Red B and Blue are not faded by several months' exposure. Celatene Yellow and Black are the poorest of these products as regards light fastness, as both are distinctly browner after a month's exposure. Light shades of these colors have an excellent fastness to washing, but the deeper shades are not as good. All are fast to chlorine except Celatene Blue, but this shade may be restored by treatment with a dilute hydrosulphite bath.

Celatene Dyes on Acetate Silk Unions

In dyeing the acetate silk in acetate silk-cotton unions with the Celatene dyes, substantive dyes may be used on the cotton, but for a uniform fastness on both fibers it is necessary to use vat dyes on the cotton in order that the fastness of the cotton may equal that of the acetate silk. This, of course, necessitates the use of two baths. The cotton is usually vat-dyed first and the acetate silk dyed last, as the hydrosulphite vat may alter the color of some of the Celatenes on the fiber. The Caledon dyes are particularly recommended for this purpose, and their application will be discussed under "Union Dyeing." Where the cotton is to be left white, a soaping, as in Methods Nos. 33, 34 or 96, may be necessary to clear it, as some of the Celatenes stain cotton slightly. The Celatene dyes are not recommended for acetate silk-wool or real silk unions.

Where direct dyes are used on the cotton, they may be applied in the same dye bath as the Celatenes. On acetate silk-wool unions, the wool takes up the Celatene dye more than does cotton, especially where heavy shades are being applied to the acetate silk, and for this reason the Celatene dyes are not recommended for this purpose. The Celatene dyes may be effectively printed on acetate silk by adding only a gum thickening to the dye and steaming the printed acetate silk.

According to British Patent No. 214,112, May 20, 1923, to W. Kilby and Morton Sundour Fabrics, acetate silk may be dyed by means of the alkaline hydrosulphite vat with amino or nitro derivatives of anthraquinone or their alkyl or halogen derivatives. For instance, 1 or 2 amino, 1,5-diamino-, 1-amino-2 methyl-, 1-methylamino-, 1-amino-2,4-dibromo-, 1-amino-5-chloro, or 1-nitro-4-chloro-derivatives of anthraquinone give yellow to red-violet shades which may be diazotized and developed. It also states that *a*-aminoanthraquinone will dye acetate silk yellow; *a*-methylaminoanthraquinone, red; 1,4-diaminoanthraquinone, violet, and diaminoanthrarufin, a blue color.

The Cellit Dyes

The latest addition to the rapidly growing list of special yroducts for dyeing acetate silk are the Cellit* dyes of the Farbenfabriken vom Friedr. Bayer & Co. As these dyes are in powder form, they may not belong to the dispersal class which we have just discussed, but as yet no definite announcement has been made regarding their constitution. However, there are several processes by which powdered products of the dispersal class could be prepared. British Patent No. 224,077 (United States Patent No. 1,534,019), given under the dispersal dyes, covers such a process. Possibly other solid water-soluble organic solvents for the insoluble acetate silk dyes may also be available. British Patent No. 204,280 (United States Patent No. 1,526,142), which follows, also covers powdered products suitable for dyeing acetate silk. Very probably the Cellit dyes are products of some such process.

At present the Cellit fast dyes are available in the following colors: Cellit Fast Yellow 2G, 2GN and R, Fast Orange G, Fast Red B, Fast Rubine B, Fast Violet 2R, Fast Brown G and Fast Blue R. All of these products are of high tinctorial power, but the violet is particularly strong, 1 per cent of C. F. Violet 2R giving a deep brilliant shade, while only from 2 to 5 per cent of the others are required to give deep shades. The fact that these products are powders gives them an added advantage in handling and shipping over pastes, as we are all familiar with the difficulties encountered with pastes evaporating, leaking, settling out, etc.

On acetate silk C. F. Red B, Rubine B, Orange G, Blue R, Yellow R and 2GN have a good fastness to washing and are about equal to the Diazo Fast types, usually exceeding the Benzo Fast colors. The C. F. Violet 2R and Brown 2G are not as fast to washing as the others. Their fastness to light is usually very good as compared with the Benzo Fast colors, but the C. F. Brown G, Blue R and Violet 2R are not as good in this respect as the others. As a class they do not withstand cross-dyeing at the boil, but this is seldom on acetate silk. Neither will they discharge to a clear white with sodium formaldehyde sulphoxylate.

All of the Cellit dyes stain cotton and viscose, but this color is readily stripped by soaping as in Method No. 96.

*The author is indebted to Dr. H. E Hager, of the Grasselli Dyestuff Corporation, for most of the data given on the Cellit dyes.

without any material change in shade of the acetate silk color. They also dye silk and wool from both acid and neutral baths, acetic acid completely exhausting the dye bath. In fact, most acetate silk dyes stain or dye silk and wool in this manner.

Method No. 95: Application of Cellit Dyes.—These products are applied in about a twenty-five to one neutral dye bath, with the addition of 50 to 100 per cent, on the weight of material, of anhydrous sodium sulphate (Glauber salt) or sodium chloride, at 60 to 71 deg. Cent. (140 to 160 deg. Fahr.). Ordinarily they may be combined with other dyes of the same or another class, for use in dyeing compound shades or unions, without difficulty. As mentioned before, when applied to unions the cotton or viscose may be cleared by Method No. 96.

Method No. 96: Clearing Cellit Stained Cotton or Viscose.—This is best accomplished by soaping *twice* at 49 to 71 deg. Cent. (120 to 160 deg. Fahr.) for about five minutes each. This leaves the interwoven cotton practically white.

British Patent No. 204,280, April 5, 1923, to the Badische Anilin and Soda Fabrik, covers the dyeing of cellulose esters by means of the bisulphite compounds of comparatively insoluble azo dyes. According to this patent, a soluble dye may be prepared by coupling the base with a suitable developer and then combining the insoluble azo compound with bisulphite to form a soluble compound. United States Patent No. 1,526,142, February 10, 1924, to F. Gunther, assignor to Badische, covers the same process, and specifies products such as anilineazo-*B*-naphthol in a weakly acid dye bath.

Dyeing Acetate Silk Unions or Fabrics Containing Acetate Silk Effects

Much has already been said upon this subject under the headings of various classes of dyes, and particularly in connection with the SRA dyes. In dyeing cotton or woolen goods with an acetate silk thread stripe effect, it is not always necessary and is sometimes not desirable to leave the acetate silk white. When this is the case, an even wider range of direct, acid or other dyes may be used on the cotton or wool than those mentioned in these articles. However, in case the acetate silk is stained, care must be taken in buying the dye that various lots of the dye, even from the same manufacturer, stain the acetate silk to the same extent, as different lots of the same dye may differ in this respect, due to dyes used in shading, as explained in Part IV. For this reason it is usually advisable to use a completely resisting dye, if possible, and dye the acetate silk stripe with some other suitable dyestuff in the same dye bath if desired.

While a wide variety of two-color effects are obtainable on acetate silk unions containing all proportions of acetate silk by the one-bath process, it will readily be appreciated that a much wider variety and even better results are obtainable by the two-bath process. In this manner even incompatible dyes may be used and a much better result obtained in all cases due to more suitable temperature, conditions, etc.

However, even with all the drawbacks, three-color effects upon three-fiber combinations are possible in some cases, but are usually a matter of considerable manipulation and are not by any means uniformly satisfactory. The difficulty in dyeing wool and silk at the low temperatures recommended for acetate silk is, of course, recognized as one of the very considerable restrictions along this line. The use of Lustron, with its greater resistance to high temperatures in the dye bath, will obviate this trouble to some extent. By means of the two or three bath method, even solid colors are obtainable on many three-fiber combinations of acetate silk.

Acetate Silk-Cotton Unions

On cotton-acetate silk unions, solid shades of yellow may be obtained with Chlorazol Fast Yellow 5GW and Citronine Y Conc. A solid brown may be obtained with Alizidine Brown M, Chlorazol Brown M and Chlorazol Brown LF. Solid blue may be obtained with Chlorazol Sky Blue GW and Prune Pure. Cellutyl Black R is a mixture especially made for a solid black on cotton-acetate silk hosiery. It is diazotized and developed with *B*-hydroxynaphthoic acid. Many other direct cotton dyes do not stain acetate silk and are suitable for use where the acetate silk is to be left white or dyed a contrasting color. It should be remembered that the same dye from a different manufacturer may not give exactly the same results as regards to staining acetate silk.

Method No. 97: Unstained Acetate Silk Effects.—Where it is desired to leave the acetate silk white or unstained, the direct dye may be applied in a twenty or better yet a thirty to one dye bath containing the necessary amount of dye and 20 to 30 per cent of sodium chloride or sulphate and worked for one hour at 71 to 76 deg. Cent. (160 to 170 deg. Fahr.). For blacks it is advisable to raise the temperature to 60 to 85 deg. Cent. (140 to 175 deg. Fahr.) and to use about 40 per cent of salt to insure penetration. Alkaline baths should be avoided and the goods should be rinsed well and soaped as in Method No. 33, No. 34 or No. 96, followed by a thorough rinsing. Turkey Red oil will aid penetration and is especially useful on light shades.

Method No. 98: White Silk Effects on Diamine Dyed Cotton Unions.—The manufacturers of the Diamine dyes recommend that on acetate silk-cotton unions they should be applied at 40 to 60 deg. Cent. (104 to 140 deg. Fahr.) in a neutral bath, with the addition of Turkey Red oil for light shades, and Glauber salt if desired. A list of Diamine dyes which should not stain acetate silk follows.

Method No. 99: The Azoniles on Acetate Silk-Cotton Unions.—In applying the Azoniles to acetate silk-cotton unions, the wet out goods are entered into a forty to one dye bath containing the Azonile dye at 40 to 49

deg. Cent. (104 to 120 deg. Fahr.). The temperature is raised to 74 deg. Cent. (165 deg. Fahr.) for one-half to three-quarters of an hour and 10 to 20 per cent of ammonium acetate is added. After dyeing the goods are rinsed in lukewarm water, diazotized as in Method No. 70A, and developed with a suitable developer as given in Method No. 70B. The cotton is dyed in a fresh bath as described in Methods No. 97 or No. 98.

Certain direct browns, reds and greens have a particular inclination to stain acetate silk slightly, and in using these dyes it is advisable to add the dye to the bath in portions and only add the salt after the bath has been brought up to temperature. If basic dyes are used on acetate cotton-unions, where the cotton is to be dyed with direct colors, the acetate silk should be dyed first, or the direct dye may act as a mordant for the basic dye on the cotton and thus cause a very considerable staining of the cotton. Means of clearing the cotton in acetate silk-cotton unions are given in Methods No. 18, No. 33, No. 34, No. 35 and No. 96. Long dye baths also aid in keeping the acetate silk clear in dyeing the cotton, and sodium chloride is preferable to sodium sulphate.

In dyeing the cotton of acetate silk-cotton unions such as hosiery with developed colors where it is desired to leave the acetate silk unstained, only Naphthol AS should be used as a developer as *B*-Naphthol and the diamines have some affinity for acetate silk and stain it pink or brownish, possible due to basic impurities. The Cellit dyes are not particularly recommended for use on acetate silk-cotton unions where a two-color effect is desired. The application of the SRA dyes to unions is covered in Part XII. The Celatene dyes are recommended for very fast shades where vat dyes are used on the cotton or viscose.

There is quite a variation in the staining properties of the direct dyes for acetate silk, but in the following list those marked (*) give particularly clear whites. The others are more adapted for use where the cotton is only to be dyed in light shades and may stain the acetate silk slightly at high concentrations.

(Note.—The author is indebted to B. K. Archer, of Kuttroff & Pickhardt for the list of Diamine dyes.)

*Pontamine Fast Yellow NX.
*Pontamine Light Yellow 5GX.
*Pontamine Fast Orange S.
*Pontamine Red 12B Conc.
*Pontamine Fast Pink G and BL.
*Pontamine Fast Blue 2GL, 4GL and SLN.
*Pontamine Sky Blue 6BX and 5BX.
*Pontamine Fast Gray B.
*Pontamine Yellow SXR, SX, SXG, GR and CH.
*Pontamine Orange 4G and R.
*Pontamine Fast Scarlet 8BS and 4BS.
*Pontamine Fast Red 8BL.
*Pontamine Blue BBF, CLG and GH Conc.
*Pontamine Navy Blue DB.
*Oxydianil Yellow G and O.
*Dianil Direct Yellow S.
*Dianil Fast Orange 2R and O.
*Dianil Light Red 12BW.
*Dianil Pure Blue PH.
*Dianil Fast Blue RL, GL and 4GL.
*Dianil Fast Gray 2BL.
*Chlorantine Black BL.
*Zambesi Black V.
*Dianil Yellow GC and 2R.
*Dianil Orange G.
*Dianil Fast Scarlet 5BSN.
*Dianil Pink BD.
*Dianil Blue H3G, H2G, G, B and R.
*Dianil Black ES, A2B and FDX.
*Erie Black NR.
*Benzo Fast Black L.
*Diazo Black BH.
*C. R. Chlorazol Violet R.
*C. R. Chlorazol Blue B and 3B.
*C. R. Chlorazol Sky Blue GW and FF.
*C. R. Chlorazol Fast Blue 2B.
*C. R. Chlorazol Fast Green.
*C. R. Chlorazol Yellow G.
*C. R. Chlorazol Fast Yellow B, FG and NX.
*C. R. Chlorazol Fast Orange AG and R.
*C. R. Chlorazol Fast Pink BK.
*C. R. Chlorazol Fast Red K.
*C. R. Chlorazol Scarlet 4BS.
*C. R. Chlorazol Fast Eosine B.
*C. R. Chlorazol Fast Bordeaux LK.
*C. R. Chlorazol Brown PB.
*C. R. Chlorazol Nigger Brown.
*C. R. Chlorazol Fast Brown No. 1 and No. 2.
*C. R. Chlorazol Drab RH.
*C. R. Chlorazol Black BH and GF.
*C. R. Chlorazol Fast Gray.
*C. R. Chlorazol Black.
*C. R. Chlorazol Cotton Fast Yellow B.
*C. R. Chlorazol Cotton Fast Orange 5R.
*C. R. Chlorazol Cotton Fast Red BL.
*C. R. Chlorazol Cotton Fast Pink 2B.
*C. R. Chlorazol Cotton Fast Violet BL.
*C. R. Chlorazol Cotton Fast Blue 4GL and FFB.
*C. R. Chlorazol Cotton Drab Brown L.
*C. R. Chlorazol Cotton Brown 2RL.
*Fast Brown M and MB.
*Erie Brown 3RB.
*Catechine BB and G.
*Chryophenine G.
*Benzo Purpurin.
*Dianol Black DL.
*Direct Black GS.
*Diamine Black HW.
Diamine Fast Yellow B, M, R, A, 4G and FF.
Diamine Yellow CP.
Oxy Diamine Yellow GG and TZ.
Diamine Brilliant Orange SS.
Diamine Fast Orange EG and ER.
Diamine Orange G and D.

Diamine Fast Rose BBF, G and B.
Diamine Rose BD, FFB, FFB extra, B extra and GD
Direct Rose T.
Diamine Brilliant Scarlet S.
Diamine Fast Scarlet GFF, 7BS and 8BS.
Diamine Fast Bordeaux 6BS.
Diamine Brilliant Bordeaux R.
Cotton Red A.
Diamine Fast Red 8BL.
Diamine Brilliant Rubine S.
Diamine Bronze Brown PE.
Diamine Fast Brown GB.
Diamine Nitrazole Green BB coupled with Nitrazole CF.
Diamine Green HS.
Diamine Dark Green NZ.
Diamine Heliotrope B.
Diamine Fast Violet FFRN and FFBN.
Diamine Fast Red Violet FR.
Diamine Fast Blue F3B, F3G, FFB and FFG.
Diamineral Blue BF.
Diamine Blue 3B.
Diamine Blue Brilliant Blue G.
Diamine Fast Brilliant Blue R.
Diamine Sky Blue FF.
Diamine Dark Blue B.
Oxydiamine Blue PG.
Diamine Fast Gray BN.
Diamine Gray G.
Diaminogene B (diazotized and developed with Resorcinol or *B*-Naphthol).
Diamine Black BH (diazotized and developed with Resorcinol or *B*-Naphthol).
Oxy Diaminogene OB and OT (diazotized and developed with Resorcinol or *B*-Naphthol).
Diamine Azo Scarlet 4BL Extra, 6BL Extra, 8B Extra (diazotized and developed with *B*-Naphthol).
Diamine Azo Fast Red 5B, 6B (diazotized and developed with *B*-Naphthol).
Diamine Azo Bordeaux B, R (diazotized and developed with *B*-Naphthol).
Diaminogene Blue NBB (diazotized and developed with *B*-Naphthol).
Diaminogene Sky Blue N (diazotized and developed with *B*-Naphthol).
Dianil Fast Scarlet 7BSN.
Dianil Light Red 6BL.
Dianil Light Red 8BW.
Dianil Blue H6G.
Brilliant Dianil Blue 3G.
Dianil Fast Red K.
Du Pont Thioflavine S.
Pontamine Fast Yellow 4GL.
Pontamine Brown R.
Pontamine Violet N.
Pontamine Bordeaux B.
Du Pont Purpurine 10B and 4B Conc.
Pontamine Copper Blue RRX.
Pontamine Blue AX.
Pontamine Brilliant Green GX.
Pontamine Fast Black LN.
Aurophenine O (suitable for light shades only).
Dianil Orange GS (suitable for light shades only).
Dianil Fast Scarlet GSN and 8BS (suitable for light shades only).
Dianil Light Red 8BL and 12BL (suitable for light shades only).
Brilliant Dianil Blue 6G and R (suitable for light shades only).

Certain direct cotton dyes withstand diazotization and development very well, and for this reason are particularly adapted for certain work where the acetate silk is to be dyed with products requiring diazotization and development. The following dyes are not materially affected by this treatment:

C. R. Chlorazol Fast Scarlet 4BS.
C. R. Chlorazol Fast Orange AG and R.
C. R. Chlorazol Fast Yellow B, FG and NX.
C. R. Chlorazol Fast Blue 2BN.
C. R. Chlorazol Yellow GX.
C. R. Chlorazol Green.
C. R. Chlorazol Dark Green PL.

THE CLASSIFICATION OF RAW SILK BY MEANS OF MECHANICAL TESTS

(*Continued from page* 621)

is reached. From this point the quality drops 1 per cent for each 22 points of cleanness appearing in 300,000 yards.

In summarizing, to obtain the final quality of the silk the per cent strength found is added to the per cent cohesion and the sum divided by two to give the average of both these values. This average per cent is then added to the per cent evenness and per cent cleanness found, and the sum of these is divided by three. From this final average figure a penalty for excessive hairiness is subtracted and the final figure is compared with the percentage appearing in the Quality Scale, which gives the quality of the silk.

(Part IV, the conclusion of this article, will appear in an early issue)

Appointment of Eskel Nordell, formerly technical director and head of the chemical laboratory of the Wayne Tank & Pump Company, to have charge of the water softener department of the company, has just been announced. Mr. Nordell, who is considered one of the foremost water treating authorities in the country, and who has been associated with the Wayne company since 1922, succeeds W. J. Hughes. He is well known for his writings and lectures on water softening subjects.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XVIII

Separate Back and Front Padding—Operation of the Plant Employed—Its Advantages—Topping Through Printing—The Plant, Its Operation and Advantages

By RAFFAELE SANSONE

WITH the present plants at disposal it is practically impossible to obtain, during a single passage, a topping of the cotton material on both sides simultaneously; the material usually must be given two passages, which may not always be convenient A plant for accomplishing a similar result, and one that effects an economy in coloring matter, labor and space, could be constructed as shown in Fig. 1.

This consists of the light iron framing K, that supports the two wetting drums or bowls E and H, turned at an equal or different speed in the shallow troughs A and B.

The bowls are of copper-plated iron. They contain four copper collars running loosely backward and forward on their round surface and arranging between them one, two, three or four spaces destined to receive the bath for the coloring operations. Such collars are kept in their allotted position through special short pressing rods fixed in position on special guides.

Wetting bowls E and H have on one side the doctors a and b, supplied with a backward and forward movement, and with a pressure that causes them to scrape back into the troughs A and B all excess coloring bath making its way outside of the printing spaces arranged by the collars already indicated.

The bottoms of troughs A and B are so inclined that the baths they contain can be made to run out by taps o and p nearly to the last drop at any time, being connected with collection vats or the waste water main, preventing loss of dyestuff, especially if the baths used are of a certain concentration and have to be re-employed.

The plant is driven at different speeds by pinion wheels worked by an independent electric motor or by other convenient means, while the fabric to be topped can be entered in a rolled state as indicated at N, being in this case spread out on the arrangement G before passing to the guide-roller c, which leads it in contact with the first wetting bowl E; or can be entered in piece-form on the small table indicated by M, being led upward on frame F, where is is freed of all folds and delivered to guide roller c.

At the opposite side of coloring bowl E is placed the second guide roller e. This serves to keep the fabric well pressed against the upper surface of the bowl itself. Both guide-rollers c and e can be raised so as to bring the cloth out of contact with bowl E.

The top of frame K has the large cylinders h and k, and below these is the hollow cylinder m. All three of such cylinders are hollow and are heated through hot air at 110 to 115 deg. Cent., introduced at the back of the plant, and produced there in a small apparatus. These serve to give the fabric a certain degree of drying before it passes below guide-rollers d and f and is pressed against the upper surface of wetting bowl H. Above this last guide-roller is placed cylinder g, and at a certain distance below the color troughs A and B cylinder n, both of which are heated through hot air at 110 to 115 deg. Cent. These again dry the material before it is wound on a wooden beam on bearings O.

Operation of the Plant

For working the plant indicated in Fig. 1, the operator's first task is to regulate the size of the space to be reserved on wetting bowls A and B for the coloring operations This is accomplished by moving the four loose collars in position on bowls E and H, and arranging the pegs on the guards before these to keep the former in their allotted positions. When this has been accomplished, the operators thread a tape through the machine, and join the end of this to the beginning of the first dyed piece of cotton cloth to be topped.

After this they prepare and enter in troughs A and B the baths that are to treat the material; place in function the doctors for scraping back all excess of coloring bath and move the machine, regulating the speed to be given

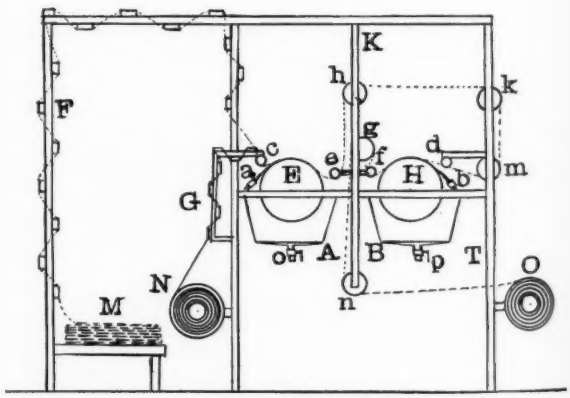

FIG. 1

to bowls E and H with the class of goods treated. Bowls E and H come thus to revolve on their axles with a certain rapidity, taking up color from troughs A and B, and the spaces separated by the collars are soon filled in this way, all excess of bath on the first being scraped off by the doctors.

As the fabric makes its way with one of its sides against wetting bowl E, it is colored and mounts on frame F in contact with the heated cylinders h, k and m. Too heavy a penetration should be avoided. On passing forward later in the machine the untopped part of the cloth comes in contact with wetting bowl H and takes up colors in a comparatively dry state, that does not mix with that first applied, especially if the material is of sufficient thickness. After this, the colored fabric passes on cylinders g and n, for drying sufficiently to allow its winding on the wooden beam on bearings O, ready to be carried to the finishing department.

Advantages of the Plant

The above plant possesses several marked advantages that can be indicated as follows:

1. Both sides of the fabric are colored superficially with the topping color during one run through the machine.

2. The material is nearly completely dried between and after the two topping operations.

3. The topping operations can be conducted while turning the coloring bowls at the same speed as the cloth, or at a greater speed, creating in the second case a certain degree of friction, and bringing about a deeper penetration of the coloring matter.

4. The topping of the cotton fabric, dyed in the direct colors, can be conducted with the basic color distributed evenly all through its surface, at a small distance from the borders, or in the form of two, three, four or five stripes.

5. If the size of the cylinders h, k, m, g and n is enlarged, these can perform a sufficient drying action to avoid further drying of the cloth as this leaves the machine.

6. Through the collars being loose on the round surface of bowls E and H, they assist the doctors in limiting the quantity of coloring solution that makes its way on bowls E and H, preventing to a certain extent the scraping that is usual on ordinary engraved calico printing cylinders, etc.

Topping Through Printing

To the writer's knowledge topping through printing is a process not extensively used, owing to the limitation of the treatment principally to the dyehouse. There is no doubt, however, that the process could be conducted to great advantage also through printing, and through its means quite satisfactory results could be obtained, when the most convenient conditions were adopted.

Among the effects that would be possible in this instance, the following can be mentioned: Simple brightening effects; lined, striped, or figured topping effects; changeable topping effects; ombre topping effects; complex topping effects; extra bright topping effects; discharge topping effects, and the relief topping effects.

For conducting the simple brightening effects a single color printing machine of the type illustrated in Fig. 2 would offer advantages.

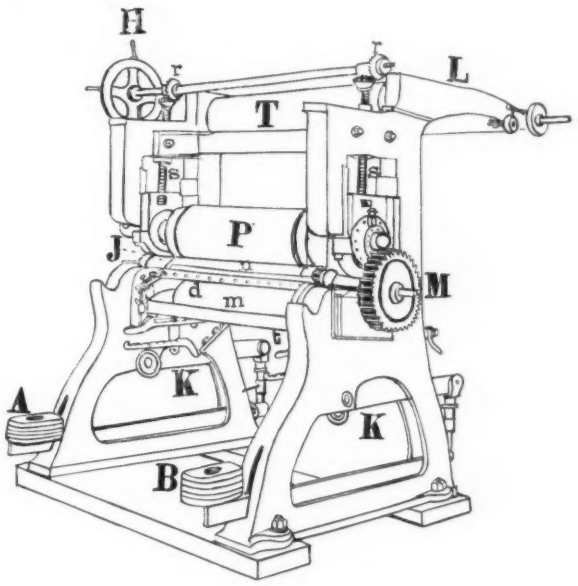

Fig. 2

The diagram shows a strong double iron frame M, altered at the base to accommodate the exceptionally powerful leverage and heavy weights A and B, that have the effect of applying an elastic pressure to the bearings supporting a single engraved printing roller, n, which turns above the impregnation roller m, placed in the copper-plated iron color trough t. The end shafts of the engraved roller can be entered in the side slits (J) on frame M.

A cast-iron cloth bowl P, supplied with an india rubber covering of a certain thickness and with a cotton backcloth, is kept under a certain pressure on printing roller n, regulated by turning the upper hand-wheel H, in its turn worked by the pair of small pinion wheels r, r, and the screws s, s. The height of the color trough t is regulated by special arrangements at each side of frame M. At the back of printing roller n is a lint doctor, which frees this roller of all fibers collected during the operation of the plant. At the top of the machine is roller T that receives the backcloth and printed fabric, and delivers them both to another beam L on a projecting pair of arms.

The machine is driven by an electric motor, directly coupled to a totally enclosed worm reduction gear of high efficiency, with hardened steel worm and ground teeth, and with worm wheel with phosphor bronze rim, the shafts being fitted with ball and thrust bearings. This

method of driving has the advantage of being remarkably compact, perfectly noiseless and without vibration, and the gearing being entirely enclosed it affords the clearest working room and greatest safety to the printer.

A color doctor is provided before the engraved roller n, indicated in the figure by d, and serves for scraping off all excess of coloring matter finding its way on the unengraved portions of the printing cylinder. This doctor is supplied with tranverse motion of the usual variable throw cam type with rocking levers.

The Operation of the Plant

The above plant is worked more or less as follows. The operators distance the pressure bowl P from the printing roller n, which has been chosen to produce the topping effects, by moving the hand wheel H, and thread through the machine two short cotton tapes, both ends of which have been fitted to the end of the cloth to be printed.

When this has been accomplished, they enter the coloring bath in trough t, raise the pressure bowl P by moving hand wheel H, and enter at its rear the backcloth, bringing this upward until reaching a guide-roller placed at a certain height above the machine, and fixing its ends to two cotton tapes threaded on other similar rollers and on the rollers of a drying frame or hot flue at the back of the plant, or on an upper story as may be more convenient.

The operators then sew the beginning of the fabric to be printed with its back against the backcloth, and enter in trough t the coloring bath prepared in a small separate apparatus, at the same time starting the machine.

In this way the cotton cloth to be topped passes at a certain speed through the machine, and is colored on the front with stripes, lines, or designs of one color in accordance with the engravings on the printing roller n, and passes little by little into the hot flue, where it is dried and delivered to the finishing room.

Advantages of the Plant

The plant and processes indicated above has several advantages, among which the following can be mentioned:

1. If the topping bath in trough t is properly regulated, the cotton fabric dyed in the direct coloring matter takes up rapidly the basic dyestuff printed on it, which has, of course, to be suitably thickened to avoid running.

2. If the composition of the topping color has been properly chosen no steaming or after-treatment of the colored fabric is necessary; thus extra expenses that might render the process too costly for many purposes are avoided.

3. If the topping is produced with vertical lines or stripes, and the printing roller instead of being placed on the feeling roller m is placed directly in the color trough t, by running it at a sufficient speed the dye bath can be taken up without any addition, and delivered to the cotton cloth. The effects, are, however, only clear in this case, and do not run together, when the engravings on the printing cylinder are very fine, and the scraping doctor and lint doctor function correctly.

4. The operators can watch the material they are treating, and can change the composition of a topping paste at the end of the first piece if the shade or color produced is not satisfactory.

5. By drying the cotton cloth after a first topping on the front it can be repassed on the machine for printing the reverse with the same or a different effect and color.

6. The production of topped cotton cloth is large, and the employment of labor quite small; whereas the preparation of the printing pastes, after some practice and experimentation, could be easily mastered.

(To be continued)

ARRANGE CHEMICAL EXPOSITION PROGRAM

The program of speakers for the intensive one-week course in chemical engineering fundamentals for college students, to be held in conjunction with the Tenth Exposition of Chemical Industries, Sept. 28, to Oct. 3, at the Grand Central Palace, New York, is gradually nearing completion. Some of the leading authorities in their respective fields in the chemical industry and associated groups, will lecture at the Students' Course at the Chemical Exposition.

Three general addresses on the chemical industry, chemistry in all industry, and the buying and selling of chemicals will be given. Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers Association will speak on "The American Chemical Industry"; Dr. Arthur D. Little on "The Application of Chemistry to Industry"; William Haynes on "Buying and Selling the Products of Chemistry."

Other speakers in the Students' Course will cover such subjects as Disintegration, Mechanical Separation, Separation, Separation with Phase Change, Handling of Materials and Materials of Construction.

The speakers scheduled thus far represent about half of the finished program for the Students' Course, it being planned to add almost an equal number of additional well-known speakers before completion of the full program. A number of leading engineers have been scheduled tentatively, and definite announcement of their addition to the program will be made later. The Course is open to all college students in chemistry or chemical engineering, or others in the industry who desire to go over a one week's course in the fundamentals of chemical engineering. Lectures will be held each morning of the Exposition at the Grand Central Palace. No charge is made to those who attend.

The motion picture program for the exposition comprises interesting films on a wide variety of subjects, covering quarrying, copper smelting, lime manufacture, cane sugar production, paper making, petroleum, gasoline and oil, sulphur, film manufacture, gasoline motors, storage batteries, spark plugs and lead mining and milling; and also includes four reels giving a brief sketch of Thomas A. Edison.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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OUR LENGTHENING DYE LISTS

ALTHOUGH few industries have had to wage so persistent a fight for existence as the American dyestuff industry, still fewer have received such lavish praise when their existence has been finally assured. But with foreign competitors ever seeking to usurp our enviable position, this generous laudation is likely to be as destructive to morale as unfavorable propaganda. Praise overdone engenders a dangerous contentment. The oftentold parable of the man who becomes so contented with his lot that he ceases to better it contains an excellent moral for whole industries as well as for the individual. Dissatisfaction, conversely, is usually seen as the mother of progress.

A thoughtful economist analyzing the report of the Tariff Commission on the latest census of dyes would possibly interpret the announcement that more than sixty new dyes were produced in this country last year as indicative of a certain amount of healthy discontent. These latest additions to the lengthening tabulation of American dyes, in other words, may be considered as reassuring evidence that our dye manufacturers have *not* been lulled into smug lethargy by the cheers and congratulations of flattering friends. Though the applause might have turned their heads a bit it did not apparently cause them to slacken their pace.

The achievements and progress of the American dyestuff industry during the past decade will doubtless earn more than brief mention in industrial history; but, fortunately for the industry, its members have kept before them the truism that future expansion rests not so much upon past triumphs as upon continued effort.

The new American dyes referred to in the census report are the industry's answer to the increased importation of foreign products. In 1923 over one hundred new dyes were developed in our laboratories, and, like those brought out last year, they were almost entirely complex products of special type and high fastness and were not restricted to any one class. Over one hundred sixty important new colors in two years may not appear to the laymen as an achievement deserving special emphasis, but the laboratory research, the tests, the trials and failures must all be considered in any estimate of its significance.

New colors are brought out by our manufacturers first because they know there is a ready market for them and secondly, because they realize that they cannot hope to retain their hard-won prestige unless they at least keep pace with the progress of foreign competitors. Should they cease to develop new colors the implication could only be that they were satisfied with the position of their industry—a condition leading to the downward path.

It is pertinent to point out in this respect that the production of an entirely new color is oftentimes not proclaimed with sufficient enthusiasm to call more than passing attention to it. There has been considerable advance in our manufacture of vat colors, yet dye import statistics for last year record the cold fact that 50 per cent consisted of vat colors.

Much of this importation consisted, of course, of noncompetitive colors which American manufacturers have not as yet duplicated. A considerable proportion, however, was classed as competitive. This leads to the belief that the one time acceptance of anything foreign as superior has not been entirely eradicated from the minds of American consumers. Increased publicity for specific American colors and for the quality of American dyes as a whole should tend to decrease the demand for imported competitives.

BUSINESS IS BETTER

PARALLELLING current reviews of general business in its optimistic tone is the acknowledgment throughout the dyestuff industry that business is noticeably better, that it has been increasing steadily and from all indications will continue to increase. The textile industry, long an outstanding exception in this year's business prosperity, has decidedly picked up within the past two months and is now responding, rather belatedly it is true, to the factors that have been favorable to expansion in other trades. Dyestuff trade, always the tail to the textile rocket, is now feeling the results of the latter's improvement.

During the last quarter of this year dyestuff manufacturers will most likely have their patience rewarded with an influx of encouragingly larger orders. It appears to one authority that hand-to-mouth buying will be steadily displaced by purchasing of a sounder character. When this has definitely come about the dyestuff and textile chemical industries will be assured of brighter prospects for some time ahead.

A talk on "The Romance of Chemistry" was broadcast September 1 through WRC, Washington, D. C., by C. C. Concannon, chief of the chemical division of the Department of Commerce.

New Dye Census Shows Drop in Production

THE United States Tariff Commission will soon issue its eighth annual Census of Dyes and Other Synthetic Organic Chemicals for 1924.

It presents the results of a special investigation made by the Tariff Commission as to the production of coal-tar dyes, intermediates, crudes, and synthetic organic chemicals of coal-tar and of non-coal-tar origin. This report contains a detailed census of dye imports and a discussion of the international dye trade with official statistics for the imports and exports of the chief dye consuming and producing nations of the world.

The total production of coal-tar dyes by seventy-eight firms in 1924 was 68,679,000 pounds, a 27 per cent decline from the maximum output in 1923 of 93,667,524 pounds. This reduction is principally due to the decreased activity in the domestic textile industry. The sales in 1924 totaled 64,961,433 pounds valued at $35,012,400. Dyes of domestic manufacture now supply about 95 per cent of our consumption, and there was an exportable surplus of certain dyes amounting to 16,000,000 pounds.

New Dyes

Notable progress was made in the manufacture for the first time in this country of many valuable dyes of high fastness. More than sixty dyes were manufactured in 1924 which were not produced in the previous year. These products show that the industry has made marked progress during the year in producing many complex types, including dyes of high fastness for cotton, wool and silk. Work now under way may be expected to add materially to the variety of dyes and other organic chemicals produced in this country.

The average price of all dyes sold in 1924—54 cents per pound—was a 2 per cent decline from that of the previous year. The average selling price in 1920 was $1.08 per pound, and in 1917, $1.26 per pound.

Production of Dyes by Classes

The 1924 output of dyes, grouped by classes according to the method of application was as follows: Acid dyes, 9,187,256 pounds, or 13.38 per cent of the total output; basic dyes, 3,676,999 pounds, or 5.35 per cent; direct dyes, 14,662,577, or 21.35 per cent; lake and spirit soluble dyes, 967,550 pounds, or 1.41 per cent; mordant and chrome dyes, 2,953,987 pounds, or 4.3 per cent; sulphur dyes, 14,561,257 pounds, or 21.2 per cent; vat dyes, including indigo, 21,818,022 pounds, or 31.77 per cent; indigo, 19,996,703 pounds, or 29.12 per cent; other vat dyes, 1,821,319 pounds, or 2.65 per cent; unclassified and special dyes, 851,354 pounds, or 1.24 per cent.

Effect of Tariff Production

A rapid increase in the monthly imports after the reduction in duty last September indicates increased competition from foreign-made dyes. The imported dyes are almost entirely of German and Swiss manufacture and consist largely of the higher cost products. The average monthly import of dyes from October, 1924, to July, 1925, inclusive, was 458,960 pounds. This is an increase of 156 per cent over the monthly average of the first nine months of 1924 preceding the tariff reduction on dyes.

Expenditures for Research

Over $2,000,000 was expended for research in coal-tar products in 1924. When the total value of the finished coal-tar products sold in the same year—$56,000,000—is considered, it is probable that expenditures for investigation in this industry have been greater than in any other industrial field. The total research costs reported to the Tariff Commission have exceeded $25,000,000 for the period 1917 to 1924. The remarkable accomplishments of the domestic dye and coal-tar chemical industry in these years must be attributed in no small part to the large expenditures for research.

Record Output of Vat Dyes

The production of vat dyes, other than indigo, was 1,821,319 pounds in 1924 as compared with 1,766,383 pounds in the previous year. Because of their exceptional fastness these dyes are in increasing demand for cotton goods, subjected to the severe treatment of the modern laundry. That they were among the last dyes to be developed in this country will be explained by the fact that they are exceedingly complex, difficult and costly to manufacture and that the patents were largely in the hands of the Germans. In addition, this group comprises a relatively small part of our total consumption. The domestic industry now supplies about 55 per cent of our requirements in this group.

Dye Imports and Exports

The total imports of coal-tar dyes in 1924 were 3,022,539 pounds valued at $2,908,778, a slight decrease from the imports of the previous year. Of these imports, 50 per cent came from Germany, 30 per cent from Switzerland, and the remainder from England, France, Italy, and other countries. The vat dyes comprised nearly 50 per cent of all dyes imported.

The total dye exports for 1924 were 15,713,428 pounds valued at $5,636,244. This is a 12 per cent decrease by quantity and a slight increase by value over the figures for 1923. Our export trade in dyes consists very largely of Indigo and Sulphur Black shipped mostly to the markets of the Far East.

International Dye Trade

Since 1914 the manufacture of dyes and intermediates has been established on a large scale in the United States, Great Britain and France, and to a smaller extent in Italy

and Japan; while in Switzerland the industry has expanded. As a result, the world's capacity to produce dyes has nearly doubled and an era of competition has set in, which promises to eliminate many of the existing plants.

These new dye industries have greatly affected Germany's export trade which in 1914 was 25 per cent by quantity and 60 per cent by value of the 1913 trade. But there is little doubt of Germany's determination to recover as large a part as possible of her lost markets, even at a high cost and over a long period of time. Germany has a large portion of the dye trade in the markets of the Far East and other consuming countries, which have no dye industries. The new dye producing countries, however, have adopted protective measures for the purpose of stimulating dye manufacture. These measures have been partly responsible for Germany's effort to affiliate with existing producers or to establish branch plants.

One development of interest by the Interessen Gemeinschaft in 1924 is the reported consolidation of interests for the purpose of reducing personnel and eliminating the duplication of production, selling and purchasing forces. Extensive developments have been made by the plants of the I. G. in the manufacture of non-coal-tar products. Conspicuous among these new items are synthetic ammonia, nitrogenous fertilizer materials and synthetic methanol. The manufacture of the latter is closely allied with other products, such as butyl alcohol and motor fuel.

The German dye industry has long been organized on an international basis. The struggle between the dye producing nations for the export markets promises to be a long and a severe one and in the end must result in the elimination from an export basis of those dyes which can not be produced at a cost sufficiently low to compete with German and Swiss products.

Switzerland ranks second to Germany in the international dye trade. They produce largely the higher cost types. The post-war export trade shows a relatively smaller decline than that of Germany. They operate branch plants in the United States, Great Britain, France and Italy. In the long run it is probable that the Swiss will find their lack of raw materials an increasing handicap in maintaining their industry on an international basis.

In the event that the German firms do not establish branch plants in Great Britain and the United States two methods are open for their pursuance of commercial warfare against the dye industry of these countries: (1) an attack on their export trade and (2) a direct attack by price cutting in the home markets on certain lines of key products. Both methods of procedure are reported to have been adopted in 1925. In the United States since the tariff reduction of 15 per cent ad valorem on September 22, 1924, a sharp increase in imports of the higher priced dyes has taken place.

In addition to the special measures which Great Britain, the United States, France, Italy, Japan and Spain have adopted to encourage and stimulate dye production, Great Britain and Japan have rendered financial aid to their dye industries, and Great Britain, Japan and Germany have put in force a license system of dye-import control. Protective measures will play an important part in the maintenance and development of the dye industries in the new producing countries within the next five to ten years. In the long run, however, such fundamentals as (1) cost of production, (2) availablity of raw materials, (3) cost and efficiency of labor and the maintenance of technical staffs, (4) efficiency of selling organization, (5) sufficient capital without excessive capitalization, and (6) ability to grant prompt and efficient technical service to consumers, will become decisive factors in determining what countries will survice this competitive era. The German and the Swiss have an advantage in a consolidation of companies not possessed by any other country. Such a consolidation in the United States would be in violation of anti-trust laws. In sharp contrast to the close cooperation in Germany between dye firms is the keen competition between the different firms in some of the new dye producing countries, particularly in the United States.

Among the world's dye producers there is manifest a distinct trend toward (1) the production of dyes of superior fastness, (2) the manufacture of dyes adapted to special purposes, (3) the development of dyes of lower application costs, (4) increase in the number of identical dyes produced by different firms, and (5) elimination of many types either in small demand or for which satisfactory substitutes are available.

The maintenance of research for the development of new dyes and allied products and for the improvement of existing methods of manufacture are important factors not to be overlooked by any nation striving to retain its international position in the dye trade. Marked advantages will result to those firms able to produce new dyes of exceptional fastness adapted to special use, and economical of application.

CHEMICAL SHOW EXHIBITS

The C. J. Tagliabue Manufacturing Company, of Brooklyn, N. Y., will feature at its exhibit at the Tenth Exposition of Chemical Industries, September 28 to October 3, at the Grand Central Palace, New York, in spaces 275-276, a variety of recording and indicating thermometers and temperature and pressing controllers. The exhibit will include the following units in the Tag line of instruments: The fully compensated recording thermometer, Peerless Temperature Controller, Peerless Pressure Controller, Simplex Pressure Controller, Dial Indicating Thermometers, Mercury Industrial Thermometers, the new thermostatically controlled Saybolt Viscosimeter and other oil testing instruments, hydrometers and chemical thermometers. Representatives of this company at the Exposition will be: L. C. Irwin, vice-president and general manager; V. Wichum, chief engineer; M. R. Wilhelm, division sales manager; W. C. Begeebing, division sales manager; M. Malone, assistant engineer; H. D. Cooke, general sales manager.

Three floors at the Grand Central Palace, comprising the exhibits of some four hundred firms manufacturing chemicals, equipment, containers, instruments and many other products, will make up the main body of the Exposition. A series of exhibits of particular interest this year, in view of the comparative recent rise of artificial silk, will be that of a number of the large manufacturers of chemical fibers, yarns, and fabrics. The combined exhibit will be entitled "Chemistry's Contribution to the Textile Industry."

The actual manufacture of chemical fibers will be carried on in the exhibit by the Max Ams Machine Company, Bridgeport, Conn., under the direction of Dr. W. O. Mitscherling. Other firms participating in the series will include the American Cellulose & Chemical Manufacturing Company, Cumberland, Md., who will show celanese or acetylcellulose fiber; Tubize Artificial Silk Company of America, Hopewell, Va., who will show nitrocellulose; the Industrial Fiber Company, who will show viscose fiber, and the American Bemberg Corp., Johnson City, Tenn., who will show cuprammonium fiber. The complete story of artificial silk will be told in these exhibits for the textile industry, dry cleaners, laundries—from the raw material to the finished textile, its manufacture, dyeing, finishing and care after manufacture.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

CORRECTION

In the "Dyestuff Tables" appearing in the issue of August 24, under the headings of "Primuline" (Schultz No. 616) and "Chloramine Yellow" (Schultz No. 617) the name of the Beaver Manufacturing Company, of Ballardvale, Mass., for whom Jennings & Co., of Boston, act as selling agents, was inadvertently omitted.

The Beaver Manufacturing Company manufactures Schultz No. 616, under the name of Primuline J, and Schultz No. 617, under the names of Direct Fast Yellow B and Direct Fast Yellow FS, the latter being similar to Diamine Fast Yellow FF.

IMMEDIAL YELLOW

(Schultz No. 710)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Equal amount of sulphide as color; 8 per cent soda; 60 per cent Glauber salt.

SHADE: Green dull shade of yellow.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well with sulphide.

FASTNESS TO:

Acid: Turns yellower.
Alkali: Fast.
Boiling: Excellent.
Cross-Dyeing: Fast.
Fulling: Excellent.
Ironing: Fast.
Light: Inferior to Chloramine Orange (S-11).
Perspiration: Moderate.
Rubbing: Moderate.
Washing: Excellent.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.), under name of Amalthion Brown R; Tower Manufacturing Company, under name of Indophenol Yellow; E. I. du pont de Nemours & Co., under names of Sulphogene Yellow D, GA and GG; American Aniline Products, Inc., under name of Sulphur Yellow Brown 2G.

IMMEDIAL ORANGE

(Schultz No. 711)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Equal amount of sulphide as color; 8 per cent soda; 60 per cent Glauber salt.

SHADE: Dull reddish shade of orange.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Poor; turns redder.
Alkali: Fast.
Boiling: Excellent.
Fulling: Excellent.
Ironing: Fast.
Light: Inferior to S-11.
Perspiration: Moderate.
Rubbing: Moderate.
Sulphur: Fast.
Washing: Excellent.

COMPETING PRODUCTS: Made in the United States by Tower Manufacturing Company, under name of Indophenol Tan; National Aniline & Chemical Company, under names of Sulphur Brown CG, 2G and 4G; Industrial Dyestuff Company, under name of Sulphur Tan; American Aniline Products, Inc., under name of Sulphur Yellow Brown MR.

KRYOGEN YELLOW
(Schultz No. 712)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Sulphide of soda; soda ash and salt at the boil. Requires a great excess of sulphide of soda to dissolve.

SOLUBILITY: Not very good.

LEVEL: Dyes level.

FASTNESS TO:
Acid: Fast to acetic; redder with muriatic.
Alkali: Fast.
Boiling: Very good after-chromed; goes redder dyed direct.
Chlorine: Slight.
Cross-Dyeing: Fairly good.
Ironing: Fast.
Light: Fairly fast.
Sulphur: Fast.
Washing: Fast.
Storing: Good.

OTHER PROPERTIES: After coppered and chromed, the fastness to light is better but the shade is duller.

DYED BY OTHER METHODS: Dyed and developed with phenol, redder and duller; with resorcin, yellow brown; with beta-naphthol, brick shade of brown; with Oxamine Developer R, a dull olive brown. Developing makes no difference in the light fastness.

PRINTING: Brands free from polysulphides print well.

DISCHARGING: Will not discharge by oxidation.

COMPETING PRODUCTS: Made in the United States by Holland Aniline Company, under name of Sulphur Yellow; Industrial Dyestuff Company, under name of Sulphur Tan Y.

SULPHUR BROWN R
(Schultz No. 715)

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: A little sulphuric soda and common salt.

SHADE: Redder and duller than Katigen Yellow Brown GG.

SHADE BY GASLIGHT: Duller.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast to organic acids.
Alkali: Fast.
Boiling: Turns lighter without bleeding.
Chlorine: Very moderate.
Cross-Dyeing: Loses in shade.
Ironing: Fast.
Light: Inferior to Katigen Yellow Browns.
Perspiration: Fast.
Rubbing: Fast.
Washing: Turns lighter without bleeding.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.

DIRECT BROWN G
(Schultz No. 476)

SPECIALLY SUITABLE FOR: Cotton and union dyeing.

USUAL METHOD OF DYEING: On cotton, with salt and after-treated with chrome and copper. On unions, with Glauber salt at the boil.

SHADE: Redder and clearer than Amanil Chrome Brown G.

SHADE BY GASLIGHT: Duller.

SOLUBILITY: Very good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Muriatic turns the shade redder; same as Amanil Chrome Brown G.
Alkali: Inferior to Amanil Chrome Brown G.
Chlorine: Moderate; turns yellow.
Fulling: Very good. Dyed direct, excels Amanil Chrome Brown G; after-treated, the same as Amanil Chrome Brown G.
Ironing: Fast.
Light: Very good.
Perspiration: Fast.
Rubbing: Fast.
Washing: Dyed direct, better than Amanil Chrome Brown G; after-treated, equals Amanil Brown.

DYED BY OTHER METHODS: After-treated with chrome and copper, faster to washing and fulling.

ON UNIONS: Cotton-silk unions: Both fibers the same shade. Cotton-wool unions: Both fibers the same shade.

ON OTHER MATERIALS: Wool: Color exhausts fairly well. Very fast to fulling and light on this fiber.

PRINTING: This product is of no interest for direct printing.

DISCHARGING: With regard to its application in discharge work, a 4 per cent shade gives the same result when discharged as a 4 per cent dyeing of Amanil Chrome Brown G. Both products give good white discharges with tin salt, sulphocyanide of tin or zinc dust; oxidizing agents give a yellow discharge.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc., under names of Amanil Brown CL and CLR; Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.), under name of Amidine Orange Brown Ex.; Cincinnati Chemical Works, under name of Benzamine Brown 3GO; Grasselli Dyestuff Corporation, under name of Benzo Brown D3GA; Noil Chemical & Color Works (Selling Agents, Dunker & Perkins Company), under name of Direct Brown C; National Aniline & Chemical Company, under names of Erie Brown CN and 3GN; Palatine Aniline & Chemical Company (Selling Agents, F. E. Atteaux & Co.), under name of Pacco Direct Brown G; Commonwealth Color & Chemical Company, under names of Trianol Direct Brown C and 3GN.

(Continued on page 644)

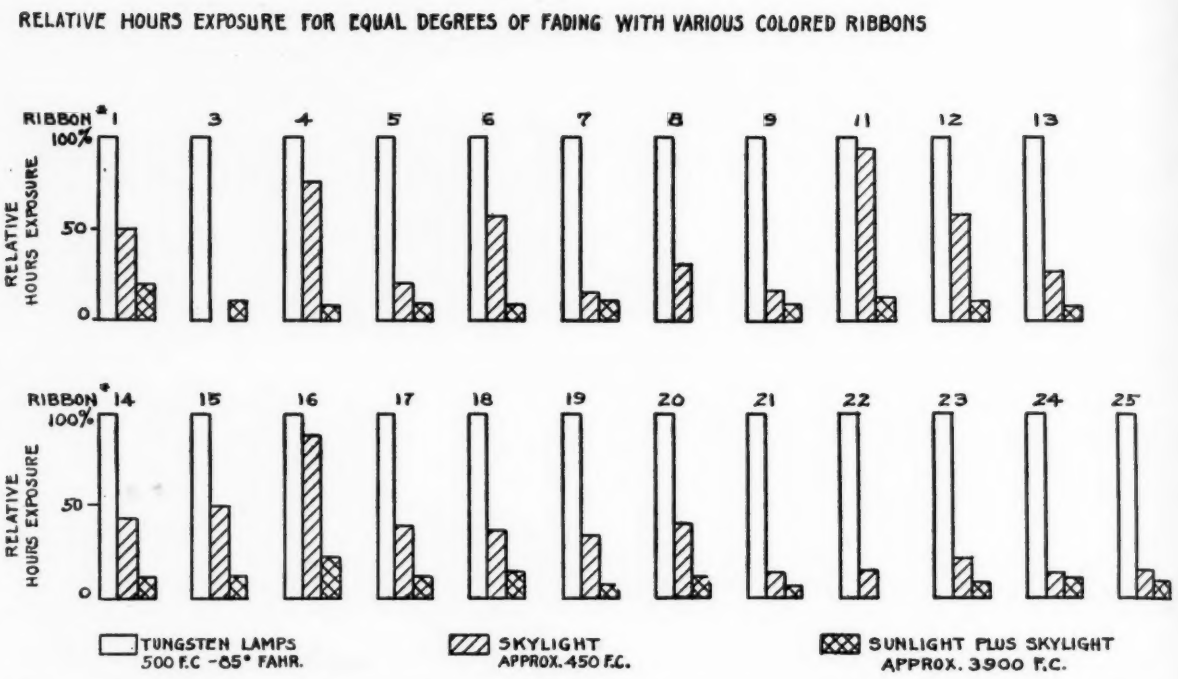

RELATIVE HOURS EXPOSURE FOR EQUAL DEGREES OF FADING WITH VARIOUS COLORED RIBBONS
RIBBON # 1 3 4 5 6 7 8 9 11 12 13
RELATIVE HOURS EXPOSURE
100%
50
0
RIBBON # 14 15 16 17 18 19 20 21 22 23 24 25
TUNGSTEN LAMPS 500 F.C -85° FAHR.
SKYLIGHT APPROX. 450 F.C.
SUNLIGHT PLUS SKYLIGHT APPROX. 3900 F.C.

FIG. 3.—*Relative Time (Hours) of Exposure to Different Illuminants to Produce Equal Fading of Various Colored Ribbons*

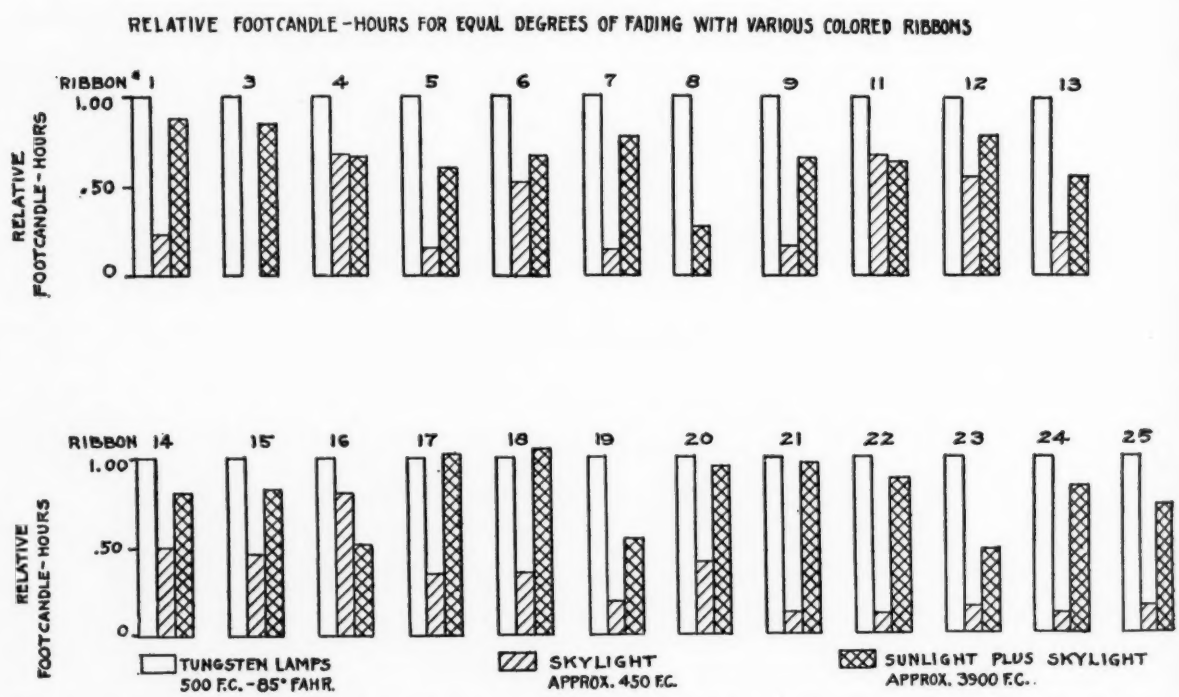

RELATIVE FOOTCANDLE-HOURS FOR EQUAL DEGREES OF FADING WITH VARIOUS COLORED RIBBONS
RIBBON # 1 3 4 5 6 7 8 9 11 12 13
RELATIVE FOOTCANDLE-HOURS
1.00
.50
0
RIBBON 14 15 16 17 18 19 20 21 22 23 24 25
TUNGSTEN LAMPS 500 F.C.-85° FAHR.
SKYLIGHT APPROX. 450 F.C.
SUNLIGHT PLUS SKYLIGHT APPROX. 3900 F.C.

FIG. 4.—*Relative Exposures (Foot-Candle Hours) Required for Different Illuminants to Produce Equal Fading of Various Colored Ribbons*

THE FADING OF COLORED MATERIAL BY DAYLIGHT AND ARTIFICIAL LIGHT

(Concluded from page 618)

survey of 26 stores in Cleveland observed an average daylight illumination of approximately 235 foot-candles on the display, with a range from 15 to 910. This average is lower than the intensity employed in our investigation.

It appears that colored goods will hardly be faded at all by exposures to 50 foot-candles for periods up to 200 hours or more, unless the dyes are more fugitive than those employed in this investigation. However, from Tables I and II it is seen that approximately half of the ribbons exposed showed some fading under the following conditions:

120 hours' exposure to 500 foot-candles from tungsten
Approximately 25 hours in sunlight.
Forty hours in skylight.

Of eighteen ribbons exposed to five foot-candles from tungsten lamps for 1,600 hours at room temperature only six showed any fading, and even they were just perceptibly faded.

The degree of fading produced by exposures to radiation from tungsten lamps is approximately proportional to the product of illumination and time over the illumination range from 50 to 2,700 foot-candles.

All ribbons tested showed some fading in solar radiation of wave-lengths greater than 557 *mu*, but the fading was greatly reduced or practically negligible for a number of ribbons when all radiations of wave-lengths shorter than 577 *mu* were screened off.

Tables IV and V show that a definite amount of fading is produced by a smaller amount of exposure, evaluated in foot-candle hours, from daylight and the white-flame arc than from tungsten lamps. This is undoubtedly due to the greater amount of short-wave radiation in solar and arc radiations.

Enclosing the colored material in a vacuum practically inhibited fading with about half of the ribbons tested, and greatly reduced the fading with all others.

Temperature has very little effect on the rate of fading in the range from 85 to 120 deg. Fahr., but at 150 degrees the fading was appreciably increased.

Moisture appears not to have a very appreciable effect on rate of fading under the conditions of this test.

The authors wish to express their appreciation for the assistance rendered by W. L. Lynde who has made a great many of the photometric measurements and comparisons of faded ribbons.

DYE PRICE REDUCTION

American Chemical & Cellulose Manufacturing Co., Ltd., Cumberland, Md., announced a substantial reduction in the price of SRA dyes, following a material increase in production.

RECENT LITERATURE

The Instructor in Garment Cleaning. C. C. Hubbard. National Association of Dyers and Cleaners. 318 pages.

This book has been prepared for the distinct purpose of improving knowledge and skill of persons employed in the important work of garment cleaning and dyeing. It is not only a practical reference book for the experienced worker, but it also contains a series of carefully planned lessons covering the essentials of the trade.

The book is very largely the result of the author's work in the Bureau of Standards, and is recommended and endorsed by the Federal Board of Vocational Education.

The material presented should aid materially in the training of more intelligent workers in the various branches of the garment dyeing and cleaning industry, and provide them with an opportunity to acquire a more thorough knowledge of their trade, than has heretofore been possible.

A large number of typical jobs in dry cleansing, spotting, wet cleaning, tinting and spot dyeing are discussed in detail as to individual operations involved, as well as to tools and materials used. In most cases these discussions are followed by a series of questions which cover the essential steps and important features of the operation.

There is also included a Dictionary of Trade Terms, a series of formulas for the preparations of various materials used by the trade, tables of weights and measures, methods for testing fabrics, and ink and paint charts giving their composition and solubilities.

DYES FOR STRAW

National Aniline & Chemical Company has issued a new shade card neatly exhibiting on straw braid swatches sixty-four of this firm's colors suitable for straw dyeing, classified on the card as acid, basic and direct, with percentages. A folder attached to the card gives brief dyeing directions for each class of dyestuff in single and two tone effects.

JULY EXPORTS OF DYEING AND TANNING EXTRACTS

Domestic exports of dyeing and tanning extracts during July were as follows, according to figures supplied by the Department of Commerce, Bureau of Foreign and Domestic Commerce: Logwood extract, 142,464 pounds, valued at $16,309; other dye extracts, 278,326 pounds, valued at $17,515; dyeing and tanning materials, crude, 811 pounds, valued at $11,068; Chestnut, 754,377 pounds, valued at $18,740; other tanning extracts (vegetable and chemical), 1,575,894 pounds, valued at $86,333.

Foreign Dyes Imported Through New York and Other Ports During August

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862.
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilinfabrik Boyer & Kegel, Furstenberg, near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldo-f. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

IMPORTS of foreign dyes through the port of New York during August totaled 306,482 pounds, with an invoice value of $275,544. Imports through other ports included: Albany, 13,553 pounds, valued at $19,180; Boston, 10,539 pounds, valued at $8,718, and Milwaukee, 100 pounds, valued at $170.

Imports of Synthetic Dyes

1925—	Pounds	Invoice Value
January	403,984	$359,376
February	373,259	365,268
March	527,964	488,501
April	451,005	426,141
May	370,271	347,904
June	376,668	333,654
July	675,843	692,615
August	330,674	303,612
Total, eight months...	3,509,668	$3,317,071

1924—	Pounds	Invoice Value
January	283,643	$237,868
February	161,869	180,570
March	302,799	307,247
April	176,550	183,789
May	183,079	177,553
June	153,019	156,857
July	143,680	139,558
August	80,396	87,014
Total, eight months...	1,440,035	$1,470,456

Dyes and Intermediates Remaining in Bonded Customs Warehouse

	Coal-Tar Dyes and Colors (pounds)	Coal-Tar Intermediates (pounds)
January 31, 1925	571,371	952,202
February 28, 1925	566,038	961,406
March 31, 1925	653,020	1,050,539
April 30, 1925	668,365	1,048,334
May 31, 1925	734,705	1,087,745
June 30, 1925	825,528	1,171,383
July 31, 1925	775,916	1,378,837

Five Leading Dyes, by Quantity, Imported During August

	Pounds
Rhodamine B (single strength)	19,470
Alizarine Light Blue B	13,006
Rhodamine 6G (single strength)	12,970
Brilliant Indigo 4B Paste	10,261
Purpurine	10,161

Per Cent of Dyes by Country of Shipment

	1925			
	Aug.	July*	June	May
Germany	51.5	57	50	50
Switzerland	36	32	32	32
Italy	4	2	5	4
England	3	3	4	6
France	3	1	3	2
Belgium	1	1	3	2
Canada	1	3	2	3
Holland	0.5	1	1	1

*These percentages do not include imports through the port of Albany.

The dyes in this report are grouped by both Colour Index and Schultz numbers, and in the case of those which could not be identified by either number the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

DYES OF COAL-TAR ORIGIN*

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
16	137	Fast Yellow Extra—(By)	10
32	182	Brilliant Sulphon Red B—(S)	2,000
69	73	Sitara Fast Red RL Paste—(t-M)	
		Sitara Fast Red RL Pdr. (s. s.)—(t-M)	1,524
130	121	Erica B Extra—(A)	
		Erica B Conc.—(S)	330
173	—	Metachrome Violet B—(A)	200
241	220	Pilatus Black SF—(B)	200
278	—	Chlorantine Fast Red 7BL—(I)	1,873
288	257	Sulphoncyanine G—(By)	489
316	273	Diaminogene Blue NA—(C)	440
319	—	Brilliant Benzo Fast Violet BL—(By)	
		Diamine Fast Violet FFRN—(C)	380
324	—	Diazo Brilliant Orange GR—(By)	200
325	—	Brilliant Benzo Violet B—(By)	
		Diamine Brilliant Violet B—(C)	730
349	—	Chlorantine Fast Yellow 4GL—(I)	2,204
382	319	Chloramine Red 3B—(S)	507
409	339	Diamine Orange B—(C)	976
423	349	Diamine Brown B—(C)	100
430	—	Pilar Red R Conc.—(G)	861
436	358	Acetopurpurine 8B—(A)	
		Chloramine Brilliant Red 8B Conc.—(S)	
		Toluylene Red Powder—(Gr-E)	3,216
449	364	Diazo Brilliant Black B—(By)	881
459	373	Congo Orange R—(By)	300
473	387	Columbia Blue G—(A)	100
487	400	Brilliant Milling Red R—(C)	200
561	449	Trisulphon Brown B Conc.—(S)	5,004
590	471	Chloramine Blue 3G Conc.—(S)	500
621	11	Chlorazol Fast Orange D—(BD)	2,000
631	14	Diphenyl Chrysoine GC—(G)	1,102
639	22	Supra Light Yellow 2GL—(By)	500
654	—	Developed Light Yellow 2G—(By)	331
658	496	Setoglaucine—(G)	551
663	500	Setocyanine—(G)	110
667	503	Poseion Green SGX—(B)	800
671	506	Erioglaucine AP—(G)	
		Erioglaucine X High Conc.—(G)	7,149
681	516	Crystal Violet Extra—(B)	
		Crystal Violet Powder—(t-M)	2,110
690	522	Victoria Blue 4R—(I)	1,102
696	528	Kiton Fast Violet 10B—(I)	1,102
704	536	Alkali Blue 3R Conc.—(t-M)	366
710	541	Isamine Blue 6B—(C)	25
712	543	Brilliant Acid Blue V—(By)	331
714	545	Carmine Blue A—(Q)	
		Kiton Blue A—(I)	
		Neptune Blue BR, BR Conc.—(M)	
		Poseidon Blue BR, BXX—(B)	4,302
715	546	Blue Extra—(C)	
		Cyanol Extra—(C)	
		Cyanol FF—(C)	1,412
717	548	Acid Violet 6BNOO—(Q)	700
720	551	Eriochrome Azurol BC—(G)	2,795
723	554	Chromazurol S Conc.—(G)	1,102
729	559	Victoria Pure Blue BO—(B)	400
735	564	Erio Green B Supra—(G)	1,102
749	573	Rhodamine B Single—(B)	
		Rhodamine B Extra (s. s.)—(Q)	
		Rhodamine B Extra (s. s.)—(I)	
		Rosazeine B Extra (s. s.)—(M)	19,470
752	571	Rhodamine 6G Extra (s. s.)—(I)	
		Rosazeine 6GD Extra—(s. s.)—(M)	12,970
757	580	Fast Acid Violet B—(M)	200
762	—	Chromorhodine BB—(DH)	
		Chromorhodine BN—(DH)	
		Chromorhodine BR—(DH)	1,762
786	—	Auracine G Formate—(G)	220
788	603	Acridine Orange DHE—(DH)	
		Rhoduline Orange NO—(By)	1,212
789	—	Patent Phosphine M—(I)	1,102
793	606	Phosphine 3R—(A)	2,000
795	607	Runic AL Conc.—(B)	700
797	608	Patent Phosphine RRDX—(B)	200
828	672	Azo Carmine GX—(B)	2,911
829	673	Azo Carmine BX—(B)	200
833	—	Wool Fast Blue BL—(By)	
		Wool Fast Blue GL—(By)	
		Xylene Milling Blue AE Conc.—(S)	3,385
851	690	Diphene Blue B—(A)	500
873	681	Direct Gray R Paste—(G)	2,822
875	923	Fur Blue Black A, SB—(A)	
		Fur Gray ALA, B—(A)	
		Fur Gray Brown SLA—(A)	
		Nako DFN, G—(M)	660
879	—	Chromazurine E, G—(DH)	661
881	624	Modern Violet N—(DH)	110

*This table includes imports through the port of New York to the amount of 306,482 pounds, and also 13,553 pounds through the port of Albany, 10,539 pounds through the port of Boston and 100 pounds through the port of Milwaukee.

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
892	635	Modern Violet—(DH)	882
1006	746	Pyrogene Green 3G—(I)	440
1027	778	Alizarine VI Extra Pure—(B)	4,192
1034	780	Alizarine Red S Powder—(B)	256
1037	783	Purpurine—(By)	10,161
1039	785	Alizarine Red SDG Paste—(M)	1,500
1040	784	Alizarine SX Paste—(B)	2,190
1053	858	Alizarine Light Blue SE Conc.—(S)	
		Alizarine Saphirol WSA Powder—(By)	3,014
1054	858	Alizarine Light Blue B, B Conc.—(S)	13,006
1060	801	Anthracene Blue SWGG Powder—(B)	500
1067	804	Alizarine Blue S Powder—(B)	720
1071	808	Alizarine Green S Paste—(B)	915
1073	852	Alizarine Irisol R Powder—(By)	938
1076	859	Alizarine Direct Blue RXO Powder—(B)	
		Alizarine Light Blue R Conc.—(S)	
1077	860	Alizarine Direct Blue BGAOO—(B)	
		Alizarine Light Blue BGAOO—(S)	1,406
1078	865	Alizarine Cyanine Green G Extra—(By)	
		Alizarine Light Green GS Conc.—(S)	230
1080	853	Anthrauinone Violet Powder—(B)	300
1081	864	Anthraquinone Green GXNO Powder—(B)	125
1091	—	Alizarine Ruby R Powder—(By)	
		Anthrarubine B—(K)	366
1095	759	Anthra Yellow GC Paste—(B)	
		Anthra Yellow GC Paste Fine—(B)	
		Vat Yellow GC Paste—(B)	3,147
1096	760	Vat Golden Orange G Dbl. Pst. (s. s.)—(B)	5,904
1097	761	Vat Orange RRT Paste—(B)	
		Vat Orange RRTS Powder (s. s.)—(B)	5,762
1099	763	Vat Dark Blue BGO Paste Fine—(B)	
		Vat Dark Blue BO Paste Fine—(B)	1,524
		Vat Dark Blue BOA Paste Fine—(B)	44
1102	765	Vat Black BB Dbl. Paste (s. s.)—(B)	
		Vat Black BB Dbl. Paste Fine (s. s.)—(B)	2,226
1104	767	Vat Brilliant Violet RR Paste—(B)	
		Vat Brilliant Violet RR Paste Fine—(B)	
		Vat Brilliant Violet RR Dbl. Pst. (s. s.)—(B)	
		Vat Brill. V'l't RR Dbl. Pst. Fine (s. s.)—(B)	
		Vat Brilliant Violet RRP Paste—(B)	2,676
1106	838	Vat Blue RS Paste—(B)	
		Vat Blue RS Paste Fine—(B)	
		Vat Blue RS Dbl. Paste (s. s.)—(B)	
		Vat Blue RS Dbl. Paste Fine (s. s.)—(B)	
		Vat Blue RSP Paste—(B)	
		Vat Blue RSP Dbl. Paste (s. s.)—(B)	396
1113	842	Indanthrene Blue GCD Dbl. Paste—(B)	
		Indan. Blue GCD Dbl. Pst. (s. s.)—(B)	
		Vat Blue GCD Dbl. Paste Fine (s. s.)—(B)	
		Vat Blue GCDN Powder (s. s.)—(B)	7,276
1114	—	Vat Blue BCD Paste—(B)	
		Vat Blue BCD Paste Fine—(B)	
		Vat Blue BCD Dbl. Paste (s. s.)—(B)	
		Vat Blue BCD Dbl. Pst. Fine (s. s.)—(B)	
		Helindone Blue IBCS Powder (s. s.)—(M)	2,764
1115	843	Vat Blue RC Paste Fine—(B)	
		Vat Blue RC Dbl. Paste (s. s.)—(B)	
		Vat Blue R Dbl. Paste Fine (s. s.)—(B)	
		Cibanone Blue G Powder—(I)	220
1118	849	Indanthrene Yellow G Paste—(B)	
		Vat Yellow G Paste—(B)	
		Vat Yellow G Paste Fine—(B)	
		Vat Yellow G Dbl. Paste (s. s.)—(B)	
		Vat Yellow G Dbl. Pst. Fine (s. s.)—(B)	7,450
1133	819	Algol Red FF Extra Paste—(By)	
		Vat Red FF Paste—(By)	2,422
1134	821	Algol Blue 3R Powder (s. s.)—(By)	
		Grelanone Violet 3B Powder (s. s.)—(Gr-E)	1,232
1135	820	Grelanone Violet BR Paste—(Gr-E)	440
1136	822	Vat Orange RRK Powder (s. s.)—(By)	880
1138	810	Helindone Yellow 3GN Paste—(M)	
		Thioindigo Yellow 3GN Paste—(K)	253
1142	830	Anthra Red RT Paste—(B)	
		Vat Red R Extra Powder (s. s.)—(By)	2,726
1143	827	Anthra Bordeaux B Paste—(B)	
		Anthra Bordeaux R Paste Fine—(B)	1,367
1145	834	Vat Gray GK Paste—(By)	400
1149	873	Vat Brown GR Paste—(B)	44
1150	833	Vat Olive IR Powder (s. s.)—(M)	984
1151	—	Helindone Brown IR Powder (s. s.)—(M)	
		Vat Brown R Paste—(M)	4,689
1152	—	Helindone Brown IG Powder (s. s.)—(M)	1,600
1163	832	Vat Violet BN Paste—(B)	
		Vat Violet BN Extra Powder (s. s.)—(B)	1,040
1171	868	Cibanone Brown R Powder (s. s.)—(I)	880
1173	793	Cibanone Blue 3G Paste—(I)	992
1178	876	Indigosol O—(By)	
		Indigosol O—(DH)	1,702
1184	881	Brilliant Indigo 4B Paste—(B)	10,261
1190	885	Brilliant Indigo B Paste—(B)	393
1199	892	Helindone Green G Paste—(M)	200
1207	912	Anthra Red B Paste—(B)	
		Anthra Red B Powder (s. s.)—(B)	
		Ciba Pink B Paste—(I)	1,667
1208	919	Ciba Bordeaux B Paste—(I)	
		Ciba Bordeaux B Powder (s. s.)—(I)	2,751
1211	910	Thioindigo Rose BN Extra Paste—(K)	995
1212	918	Ciba Red 3B Powder (s. s.)—(I)	
		Helindone Reddish Violet IRH Paste—(M)	
		Thioindigo Red 3B Paste—(K)	
		Vat Red 3B Paste—(Q)	
		Vat Red Violet RH Paste—(B)	7,812
1217	913	Helindone Orange R Powder (s. s.)—(M)	
		Thioindigo Orange RI Paste—(K)	
		Thioindigo Orange R Paste—(K)	2,541
1220	899	Ciba Gray G Paste—(I)	662
1227	904	Helindone Brown G Paste—(M)	200
1227	904	Thioindigo Brown G Paste—(K)	1,000
1228	907	Anthra Scarlet GG Paste—(B)	1,000
1228	907	Ciba Scarlet G Extra Paste—(I)	1,432
1228	907	Helindone Fast Scarlet C Paste—(M)	1,000
1228	907	Thioindigo Scarlet 2G Paste—(K)	2,500
1229	908	Ciba Red R Paste—(I)	7,274
1230	911	Ciba Orange G Paste—(I)	1,102

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Acid Pure Blue R Supra—(G)	1,102
Acid Rhodamine BG—(B)	400
Azo Rhodine 2B—(S)	100
Brilliant Acid Blue G—(I)	441
Brilliant Scarlet N—(B)	300
Brilliant Wool Blue FFR—(By)	200
Cloth Fast Yellow G—(I)	1,653
Guinea Blue A—(A)	500
Guinea Fast Red BL—(A)	235
Indocyanine B—(A)	2,000
Ink Blue BJTN Powder—(Gr-E)	100
Lanasol Blue R—(I)	110
Milling Brown R—(A)	100
Milling Yellow O—(C)	250

Name of Dye and Manufacturer	Quantity (pounds)
Neolan Yellow GR—(I)	220
Orthocyanine B—(A)	1,500
Polar Orange R—(G)	1,102
Polar Red R Conc.—(G)	551
Sulphon Orange G—(By)	309
Sulphon Yellow 5G—(By)	463
Supramine Brown R—(By)	221

Vat Dyes

Anthra Wool Black 3B Vat Solid—(B)	3
Anthra Wool Black R Vat Solid—(B)	3
Anthra Wool Black T Vat Solid—(B)	3
Anthra Wool Brown CM Vat Solid—(B)	3
Anthra Wool Brown CM Powder—(B)	3
Anthra Wool Brown CV Vat Solid—(B)	3
Anthra Wool Red BB Vat Solid—(B)	3
Anthra Wool Red CR Vat Solid—(B)	3
Anthra Wool Yellow CG Powder—(B)	3
Anthra Wool Yellow CG Vat Solid—(B)	3
Cibanone Blue 2G Paste—(I)	220
Helindone Brown 12G Powder (s. s.)—(M)	4,000
Helindone Printing Black RD Paste—(M)	5,000
Helindone Red IGG Paste—(M)	200
Hydron Bordeaux B Dbl. Paste (s. s.)—(C)	100
Hydron Bordeaux R Dbl. Paste (s. s.)—(C)	100
Hydron Brown G Paste—(C)	1,400
Hydron Pink FB Paste—(C)	1,000
Hydron Pink FF Paste—(C)	
Anthra Pink R Extra Paste—(B)	2,556
Hydron Scarlet 3B Paste—(C)	440
Vat (Hydron) Sky Blue FK Paste—(C)	1,433
Thioindigo Rose RN Extra Powder (s. s.)—(K)	600
Vat Blue RL Paste—(B)	
Vat Blue RL Dbl. Paste (s. s.)—(B)	132
Vat Blue RZ Paste—(B)	
Vat Blue RZ Dbl. Paste (s. s.)—(B)	132
Vat Blue RRZ Paste—(B)	
Vat Blue RRZ Dbl. Paste (s. s.)—(B)	132
Vat Blue Green B Paste—(B)	
Vat Blue Green B Paste Fine—(B)	
Vat Blue Green B Dbl. Paste (s. s.)—(B)	
Vat Blue Green B Dbl. Paste Fine (s. s.)—(B)	1,304
Vat Brilliant Blue R Paste—(B)	
Vat Brilliant Blue R Paste Fine—(B)	
Vat Brilliant Blue R Dbl. Paste (s. s.)—(B)	
Vat Brilliant Blue R Dbl. Paste Fine (s. s.)—(B)	264
Vat Brilliant Violet RRBA Dbl. Paste (s. s.)—(B)	88
Vat Brown 3R Paste—(B)	
Vat Brown 3R Paste Fine—(B)	88
Vat Golden Orange 3G Paste—(By)	400
Vat Green 2G Dbl. Paste (s. s.)—(B)	770
Vat Yellow FFRK Paste—(B)	44

Mordant and Chrome Dyes

Acid Alizarine Gray G—(M)	1,000
Acid Anthracene Brown PG—(By)	600
Alizarine Fast Gray 2BL Powder—(By)	1,381
Alizarine Light Gray BS Conc.—(S)	4,130
Anthracene Chromate Brown EB—(C)	440
Chromazone Red New Conc.—(G)	440
Chrome Printing Red B Powder—(DH, I)	330
Chromophenine FKN—(DH)	110
Chromorhodine 6GN Extra—(DH)	441
Erio Anthracene Brown R—(G)	110
Erio Chrome Red B—(G)	110
Metachrome Blue GFL—(A)	91
Metachrome Blue Black 2BX—(A)	1,000
Metachrome Violet 2R—(A)	200
Ultra Cyanine RB—(S)	1,000

Direct Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Benzo Fast Gray BL—(By)	500
Benzo Fast Heliotrope 4BL—(By)	441
Benzo Fast Light Scarlet—(By)	100
Benzo Fast Orange 2RL—(By)	463
Benzo Fast Yellow RL—(By)	816
Benzo Red 12B—(By)	100
Benzoform Red 2GF—(By)	5
Benzoform Yellow GL—(By)	10
Brilliant Benzo Violet 2R—(By)	550
Brilliant Congo Violet R—(A)	220
Brilliant Copper Blue GW—(A)	60
Brilliant Sky Blue 8G Extra—(By)	1,213
Brilliant Sky Blue R—(By)	200
Chloramine Light Violet R Conc.—(S)	500
Chlorantine Fast Violet RL—(I)	2,204
Chlorazol Fast Orange AG—(BD)	1,670
Columbia Catechine A—(A)	10
Developed Blue 4GL Extra Powder—(By)	385
Developed Brilliant Green 3G—(By)	110
Developed Brilliant Orange 5G Extra Powder—(By)	220
Developed Brilliant Scarlet 2BL Extra Powder—(By)	441
Developed Pink B—(M)	476
Diamine Azo Fast Green G—(C)	275
Diamine Catechine 3G—(C)	150
Diamine Fast Brown GB—(C)	500
Diamine Fast Orange LG, ER—(C)	1,300
Diazo Brilliant Scarlet 3BA Extra—(By)	5
Diazo Fast Black Extra—(By)	25
Diazo Geranine B Extra—(By)	400
Diazo Rubine B—(By)	607
Diazophenyl Black V—(G)	2,205
Direct Cutch Brown GR—(I)	992
Direct Fast Orange K—(I)	2,204
Direct Fast Violet BL—(By)	220
Fast Cotton Gray GL, VL—(A)	600
Napthochrome Violet R—(I)	661
Pluto Black G Extra—(By)	430
Pluto Brown GG—(By)	100
Rosanthrene Orange R—(I)	882
Rosanthrene Pink—(I)	110

Dyes for Artificial Silk

Azonine Direct Blue B—(C)	500
Celatene Fast Light Brown—(SD)	50
Celatene Fast Light Yellow—(SD)	50
Celatene Gold Orange—(SD)	50
Duranol Orange G—(BD)	172
Duranol Red G—(BD)	336

Rapid Fast Dyes

Rapid Fast Pink LB Paste—(A)	300
Rapid Fast Red GL Paste—(A)	400

Sulphur Dyes

Pyrogene Pure Blue 3GL—(I)	661
Sulphide New Blue BL—(M)	551
Sulphide Violet V—(M)	200
Thional Brilliant Blue 2G Conc.—(S)	1,000
Thionol Brown O—(BD)	2,240
Thionol Brown R—(BD)	3,521
Thionol Direct Blue S—(BD)	600

Basic Dyes

Brilliant Acridine Orange R Conc.—(Roh.)	110
Rhodamine 6GDN Extra (s. s.)—(By)	980
Rhoduline Blue R—(By)	2

Technical Notes from Foreign Sources

Treatment of Fabrics Containing Artificial Silk

Mercerization as ordinarily applied has a deleterious effect on cellulose artificial silk, that is, viscose silk, cuprammonium silk and nitrocellulose silk. If, however, the fiber is given a preliminary treatment with a protecting sizing agent, such as gelatine, albumin, or starch, and after exposure to the mercerizing solution is treated with dilute acid in order to remove the alkali rapidly, the appearance of the fiber, notably its luster, is considerably modified (depending mainly on the tension employed) without materially affecting the strength of the thread. For instance, if no tension is used an appearance resembling real silk is obtained. In this case, however, the thread may contract as much as 20 per cent of its original length.

This process may be applied to mixed fabrics which contain cellulose silk, cotton or other mercerizable fiber. Where it is desired to scour, bleach or "wet out," the fabric prior to mercerization, the protective agent may be rendered sufficiently resistant to water by the addition of aluminum acetate to it. Glycerine may be present in the mercerizing liquid as an additional protective agent.

An example of the application of the process is as follows: Artificial silk in the skein form is sized with a 1¼ per cent solution of gelatin. The silk is then hydroextracted, dried and steeped for about 3 minutes in a solution of sodium hydroxide at a temperature of 16 to 18 deg. Cent. The density of the caustic soda solution is 1.3. The skeins of artificial silk are then rapidly hydroextracted, immersed in a 5 per cent solution of sulphuric acid until the alkali is completely neutralized, washed, and finally dried without or with but slight tension. Cellulose silk which is sized in the hank with a solution containing 1¼ per cent of gelatin and the same percentage of a solution of aluminum acetate, density 1.04, is woven with cotton, and the fabric, with or without scouring or bleaching, is passed through a solution of sodium hydroxide of 1.24 density at a temperature of 18 to 21 deg. Cent. The treated fabric is transferred directly into a 4 to 5 per cent solution of acid, and after washing is finished in any desired manner. If tension has been used during the operation the cellulose retains its original luster. (British Patent No. 230,187.)

Katanol W

This is a substance that possesses important properties and is very useful in the dyeing operation. One of its main advantages is that when it is added to the color bath, the absorption of the substantive coloring matter both by wool and silk is very limited, while the absorption of coloring matter by the cotton fiber is not changed. Thus it is useful in dyeing mixed fabrics.

The dyeing of half woolen fabric has been carried out, ever since the substantive coloring matters have been used for this purpose, in neutral color baths containing sodium sulphate. In certain individual cases an attempt has been made to substitute for the Glauber salt, because of its injurious action on the woolen fiber, particularly when the dyeing is carried out at elevated temperatures, other materials or to add other reagents for the purpose of negating to some extent the harmful action of the sulphate. If, for example, the half wool fabric is colored in one color with the aid of a Glauber salt color bath, then it often happens that the wool part of the fabric is darker in color than the cotton part, while the reverse effect is what is generally wanted. The fact that the wool is darker colored is due to an improper selection of the substantive coloring matter or else to too high a temperature during the dyeing process. If in a given case it happens that the cotton is not colored as dark as the wool and it is necessary to increase the depth of shade on the cotton part of the fabric, it is impossible to do this by repeating the dyeing in the same color bath. What would happen if this were tried would simply be that the wool would again absorb more coloring matter and become still darker in shade.

In this case it is well to use this new dyeing assistant, Katanol W. About 3 per cent of Katanol W is added to the color bath, the Katanol being dissolved in hot water and then the suitable benzidine coloring matter is added and the goods are dyed in this color bath at a temperature varying between 75 and 80 deg. Cent. The dyeing is continued until the cotton is completely colored, in the proper depth of color. The Katanol W sees to it that no more color is absorbed by the woolen part of the fabric. It is thus possible to use the Katanol not only when the woolen part of the fabric appears to be dyed too deeply, and hence it becomes necessary to deepen the color on the cotton part, but also when it is observed that the color of the wool is deep enough and matches the sample and it is desired not to make this color any deeper.

The Katanol W should not be added at the beginning of the dyeing process for the reason that the absorption of color by the woolen part of the fabric will be very greatly reduced thereby with the result that the cotton part will become deeper dyed than the woolen part and a fabric will then again be obtained which will not be dyed uniformly throughout.

For further details see Deutsche Faerber Zeitung, 1925, 107-8.

Dyeing Apparatus

When dyeing union piece goods in light tones with two co-acting dyeing machines better equalization of the bath and more level dyeing are obtained by providing each piece of apparatus with an auxiliary pressure vessel and pump. The liquor is pumped from the pressure vessel

into the apparatus, and the outflow from this is fed into the pressure vessel of the second apparatus and draws with it a further quantity of liquor from its own pressure vessel by an injector action. (British Patent No. 232,494.)

Wool as an Amphoteric Colloid

Wool is regarded as a typical amphoteric colloid which can be combined with acids and bases by virtue of its amino and carboxyl groups and also of the keto and enol forms of its —CO.NH— groups. The percentage neutralization of the wool by acids or bases thus depends on the hydrogen ion concentration of the solution. With four varieties of wool combination with hydroferrocyanic acid was found to begin at a pH of 4.8 to 4.9, and this is, therefore, approximately the iso-electric point.

In the acid dye bath mineral acid is required both to liberate the color acid from its salt and to render amino groups of the wool available for combination. The wool combines with both the color acid and the inorganic acid, and if too much of the latter is added combination with the former is diminished. The "stripping" action of sodium sulphate is likewise ascribed to the increased concentration of inorganic anions.

The dyeing of de-aminated wool with acid coloring matters is due to the numerous —CO.NH— groups. The electrical charge on wool in certain solutions is ascribed to a membrane equilibrium, and then when the dyestuff is colloidal this charge, which is produced by combination of the wool with an acid or base, may be the immediate cause of dyeing. The adsorption theory of dyeing postulates combination by secondary valencies, but this is unnecessary in those cases when strong primary valencies are available. The electrical and adsorption theories of dyeing are thus regarded as particular cases of the chemical theory.

For further details of this interesting exposition on the chemical theory of dyeing of wool, see Jour. Soc. Dyers and Colourists, 1925, pages 172-9.

Dyeing Animal and Vegetable Fibers

Animal and vegetable fibers and materials, including furs, feathers and leather are dyed in various shades by means of products which are formed in the presence of metallic salts or oxides by the action of nitrous acid on phenols of the benzene series, particularly salicylic acid, the operation of dyeing being effected by impregnating the material with a salicylate and afterward treating it with nitrous acid or by immersing it in a liquor which contains the components of the reaction.

Nitrous acid may be produced in the dyeing liquor by the action on a soluble nitrite of an acid or a substance that is capable of functioning as an acid. Such substances as a bitartrate or copper sulphate are employed. Then the material may be prepared with a salicylate by treatment with an aqueous solution which contains a salicylate and a metal salt.

The shades obtained are determined by the amount of salicylic acid and by the character and proportions of the metallic salts and oxide used. Yellow, green and red shades are obtained by means of ferrous, ferric and nickel or copper sales respectively. Pattern effects on dyed material are obtained by treatment of the dyed material with a metal or metal salt different from that employed in the operation of dyeing.

Polychromate effects are obtained by mordanting the fabric with a metal salt which is susceptible to the action of light, for example a ferricyanide, ferric salts, salts of mercury, manganese, cobalt, and uranium; exposing certain portions of the fabric to light, and afterward dyeing it by means of salicylic acid and nitrous acid. (British Patent No. 280,128.)

Influence of Sunlight on Wool

Investigations have been made on the effect of sunlight on wool by various investigators. It is a fact that sunlight has a certain deleterious action on wool. Thus in the case of dark natural wool the ends of the woolen fibers can be seen to have become bleached. When the ends of the fiber are examined under a microscope it is easy to see that the scaly structure of the woolen fiber has been destroyed. Furthermore, the chemical properties of woolen fibers which have been bleached in this fashion are seen to be changed to a marked degree. For example, this sort of wool dissolves easily in alkalies, and in fact to a certain degree in water itself.

In order to determine quantitatively the proportion of wool that is soluble in water the solubility factor or coefficient is employed and this is defined to give the number of parts of wool that are dissolved in water after a two-hour treatment with water at a temperature of 95 deg. Cent. Thus in a certain wool it was found that the unbleached wool was soluble to the extent of 0.12 per cent in water while the wool ends were soluble to the degree of 4.5 per cent. In another case the main part of the fiber was soluble to the extent of 0.12 per cent likewise while the solubility of the wool ends increased to 9.0 per cent. Both wool samples were taken from the back of the sheep.

Furthermore, it has been found that wool which has been exposed to the action of sunlight will absorb chemical in different proportions than wool which has not been thus exposed. Acids are absorbed more strongly than alkalies. Then again, as far as the dyeing properties of the fiber are concerned, the wool behaves differently after it has been exposed to light. Thus light exposed wool will dye a lighter shade with Indigo than normal wool. Other coloring matters, such as Anthracene Brown SWN give darker shades.

From an address delivered by W. V. Bergen at the tenth meeting of the International Society of Chemists and Colorists in Zurich, Switzerland.

Injurious Textile Agents

The injurying of the textile fibers and the development of damaged spots on the fiber and fabric are naturally dependent on the material itself, the place in which it is stored, and on the time that it is allowed to remain in

storage. This makes it a very difficult matter to determine just why a certain roll of cloth has become damaged.

Faults that develop in the textile material can be differentiated as occurring either before or during the finishing treatment. For example, to the defects that can arise in the material itself belong the so-called dead or unripe cotton, silk louse and the like. Then again helios spots, which are developed during the process of spinning and weaving. There are the many spots that are found on fabric and that arise from contact with unsaponifiable oils.

The literature on the subject is very great and the information is scattered throughout a large number of publications which makes it a rather confusing situation. In the address of which this is an abstract, delivered at the Tenth meeting of the International Society of Chemists and Colorists in Zurich, the author spoke of the work he has done on this matter and of the classification of defects and errors in the textile fabric that he has evolved. Of particular importance is the tracing of the fault to the operation in which it developed. This is manifestly a difficult matter but it has to be done if the cause of the error is to be found and steps taken to prevent the damage to the fabric in the future.

DYESTUFF TABLES

(*Continued from page 635*)

SULPHUR BLACK

(Schultz No. 720)

SPECIALLY SUITABLE FOR: Cotton yarn and pieces.

USUAL METHOD OF DYEING: Common salt and sodium sulphide. After-treated with chrome and copper.

SHADE: Bluish shade of black.

SHADE BY GASLIGHT: Deeper.

SOLUBILITY: Varies.

LEVEL: Good in black; requires care in light grays.

EXHAUSTS: Varies.

FASTNESS TO:

Acid: Good.
Alkali: Fast.
Boiling: Fast after-chromed
Chlorine: Moderate; decolored in one-half hour by ½ deg. Be. chloride of lime.
Cross-Dyeing: Excellent.
Ironing: Temporarily redder.
Light: Excellent. Type for Class 7 (German classification) will stand ninety days' sunlight.
Mercerizing: Excellent type for Class 5 (German classification).
Perspiration: Fast.
Potting: Fast.
Rubbing: Fast (see below).
Washing: Fast. Boiled for one-half hour with soap and soda, the dyed shade bleeds slightly into white cotton.
Storing: Very good.

Remarks: Rubbing: Neither with the oxidation blacks or with the sulphur blacks can dyeings absolutely fast to crocking be obtained. If, however, sufficient sulphide is used the goods will rub only slightly.

DYED BY OTHER METHODS: After-treated with chrome and copper, the shade goes bluer and more bloomy. By rinsing the direct dyed shade in a weak caustic soda solution and steaming thirty minutes, a blue-black shade is produced which is fuller than that produced with chrome and copper.

ON OTHER MATERIALS: Silk: On silk, gray shades are produced which are fast to boiling soap, cross-dyeing and extremely fast to light. This color is largely used by manufacturers of decoration silks in light gray tones for cross-dyeing in so-called silk-white worsteds.

COMPETING PRODUCTS: Made in the United States by Grasselli Dyestuff Corporation under names of Katigen Deep Black GGN Conc. and Sulphur Black GAC and GR; E. I. du Pont de Nemours & Co., under names of Sulphogene Carbon 8G, H and M; E. C. Klipstein & Sons Company, under name of Sulphur Black; National Aniline & Chemical Company, under names of Sulphur Black BGK, F and R.

SULPHOGENE CARBON 2 BLACK FF

(Schultz No. 724)

SPECIALLY SUITABLE FOR: Cotton yarn and pieces.

USUAL METHOD OF DYEING: Soda ash salt and sulphide of soda.

SHADE: Full bluish black; bluer than S-720.

SHADE BY GASLIGHT: Deeper and greener.

SOLUBILITY: Good.

LEVEL: Difficult; oxidizes easily.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Red with mineral acids; original shade returns on rinsing.
Alkali: Fast.
Chlorine: Destroyed.
Fulling: Excellent.
Ironing: Fast.
Light: Excellent.
Perspiration: Good.
Rubbing: Same as remarks under 720.
Sulphur: Fast.

OTHER PROPERTIES: Bronzes very easily.

DYED BY OTHER METHODS: Best dyed with 5 per cent soda ash, 30 per cent salt, 10 to 15 per cent dye and 3 to 5 per cent sulphide of soda. After-treated with peroxide and ammonia gives a dull Indigo blue which is not fast to acid or washing, but is of excellent light fastness.

ON UNIONS: No interest.

ON OTHER MATERIALS: No interest.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.

RECENT PATENTS

Process for Production of Transparent Effects in Cotton Fabrics

(1,542,202; June 16, 1925)

Robert Zimmermann, Tubach, Switzerland, assignor to the Firm Textilwerk Horn A.-G., Horn-on-the-Bodensee, Switzerland.

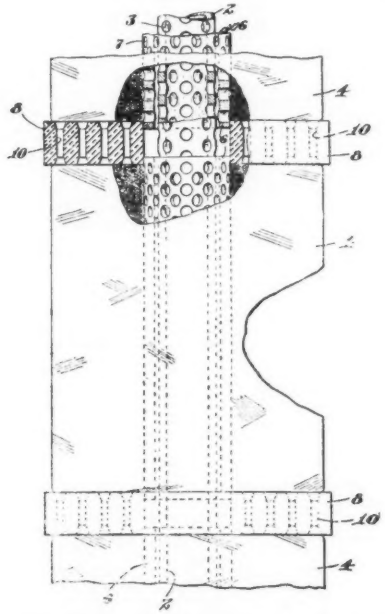
Process of producing soft, pliable cotton fabrics having a transparent effect, which comprises treating the fabric with a bath containing at least 69 per cent of sulphuric acid, water, and at least 5 per cent of ammonium sulphate, the percentage of acid being higher the higher the percentage of ammonium sulphate.

Apparatus for Package Dyeing

(1,543,643; June 23, 1925)

George C. Guild, Clinton, Mass.

In apparatus of the class described, a series of packages wound upon suitable supporting centers adapted to permit the circulation of fluid into said packages,



yieldable spacing means interposed between packages adapted to permit the same to be longitudinally compressed, and means adapted to keep packages substantially axially aligned.

Albumen Dyestuff Compound and Method of Making Same

(1,543,543; June 23, 1925)

Oscar Bally, Basel, Switzerland, assignor to the Firm Haco-Gesellschaft A.-G. Bern, Gumligen, Switzerland.

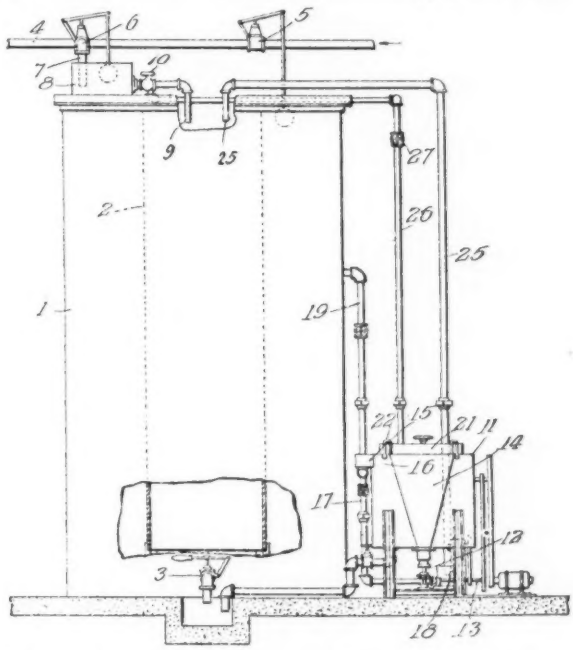
Method of making a therapeutically useful albumen dyestuff compound insoluble in water, comprising treating an albuminous body with a thiazine dyestuff so as to form an albumen leuco dyestuff compound and converting same into the albumen dyestuff compound by oxidation.

Water-Softening Apparatus

(1,546,374; July 21, 1925)

Robert O. Friend, Chicago, Ill.

In a water-softening apparatus of the kind specified, means for effecting feed of a predetermined quantity of chemical solution to a predetermined volume of water to be softened, including a container for water under pressure, a ball-cock controlling the influx of water to said container for maintaining a substantially constantly uniform level of water in said container, an outlet pipe for water to be softened associated with said container and adapted to maintain a constantly uniform flow therefrom, a source of supply of chem-



ical solution adapted for admixture with said water flowing from said outlet pipe, a second supply-pipe for water operatively associated with said source of supply of chemical and adapted to maintain a constantly uniform flow of water at a predetermined rate and ratio to the flow from said first named supply pipe for effecting a flow of said chemical solution from said source of supply equal to the weight and rate of flow of the water discharged from said second supply pipe.

Softening of Acid-Treated Fabrics

(1,546,121; July 14, 1925)

Robinson Percy Foulds and Frank Leslie Barrett.

The process of treating cotton fabric which comprises incompletely parchmentizing the fabric with sulphuric acid of somewhat less than 1.55 spec. grav.

in presence of formaldehyde and then softening the fabric by exposure to sulphuric acid of less than parchmentizing strength.

NEW PONTACYL AND PONTAMINE COLORS

E. I. du Pont de Nemours & Co. have placed on the market two new products, Pontacyl Green NV Conc. and Pontamine Fast Orange 2G Conc.

The first, an addition to this firm's regular line of Pontacyl colors, is recommended for the woolen trade and is chiefly of interest for dyeing dress goods, especially for the production of navies on this type of material. The announcement states that it levels exceptionally well and can be fed on in the boiling bath and that its light yellow shade in combination with the violets which must be used gives a very fine lively blue with good overhand. This color counteracts the increased redness which violets generally assume under such conditions. It is further stated that Pontacyl Green NV Conc. leaves cotton, rayon or Celanese effect threads exceptionally clear when dyed in an acid bath.

Pontamine Fast Orange 2G Conc. is described as a direct color which possesses not only good fastness but good working qualities and therefore finds a wide use, as it can be used on all types of circulating machines as well as on a padder and for cotton in any stage of manufacture when the best types of direct colors are required.

This product, it is claimed, has very good fastness to acids and perspiration, good resistance to water, washing and alkalies.

Two important additional properties claimed for this new orange are, first, its ability to discharge easily to a clear white with Sulphoxite C on both cotton and silk, and, second, the retention of its shade when diazotized and developed. It is a color that can be used on unions of silk or rayon and leaves Celanese unstained.

SANDOZ ANNOUNCES NEW DIRECT FAST CYANINES AND ACID COLORS

In response to the demand for cheap Direct Blues of better fastness, Sandoz Chemical Works, Inc., has brought out three Direct Fast Cyanines. These new Sandoz Cyanines are described as less expensive than the ordinary type of Direct Blues 2B and 3B, etc., and of much better fastness to washing. The products are discharged white with hydrosulphite and are of good fastness to acids and alkalies.

The new addition to this manufacturer's Acid Colors is known as Xylene Light Red 2GL and is described as of excellent fastness to light. It is especially suitable for self shades, or in combination with other fast to light level dyeing acid colors. It is claimed to be as fast to light as the class of Rubinols. Because of its fastness to hot pressing, rubbing, perspiration, alkalies, washing and carbonizing this color is recommended for the dyeing of ladies' dress goods, upholstery, mohair and drapery materials as well as carpet yarns and hats.

Carl H. Greene, for several years identified with the textile industry at Fort Plain, N. Y., has taken the position as sales manager of the North American Dye Corporation, Mount Vernon, N. Y. He plans to leave October 1 on a six months' business trip to South America and the West Indies.

MACHINERY

Dyeing machines, winding engines, cutting presses and sewing machine benches for sale. For particulars write H. S. Hall & Co., Inc., 215 Suydam Avenue, Jersey City, N. Y.

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Office manager wanted for Chicago office of dyestuff and chemical manufacturers. Person desired who has practical knowledge and experience in the same industry. Reply Box 309, American Dyestuff Reporter.

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DYER

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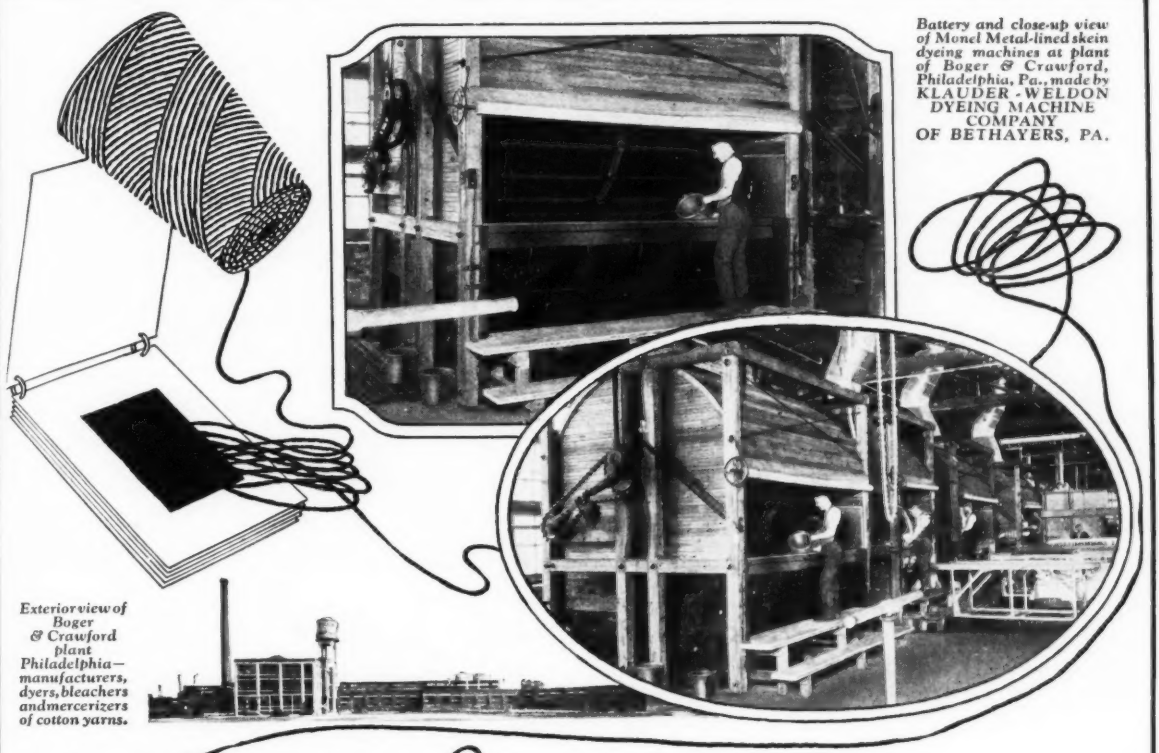

Battery and close-up view of Monel Metal-lined skein dyeing machines at plant of Boger & Crawford, Philadelphia, Pa., made by KLAUDER-WELDON DYEING MACHINE COMPANY OF BETHAYERS, PA.

Exterior view of Boger & Crawford plant Philadelphia—manufacturers, dyers, bleachers and mercerizers of cotton yarns.

Color Uniformity

Monel Metal's cleanability simplifies the sample matching problem

Send for "List B" of Monel Metal and Nickel Literature

DYEING—either in the skein or piece—is largely a matching problem. With the old type wood machines, accurate matching was generally a matter of guesswork and experiment, because of the difficulty in cleaning the machines.

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Any way you look at it, Monel Metal dyeing equipment is economical. It will pay you to Monel Metallize your plant either by installing new Monel Metal equipment or re-lining your old machines with Monel Metal.

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in the English Language

Edited by

F. M. ROWE, D.Sc., F.I.C.

assisted by
C. LEA, M. Sc. Tech.
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